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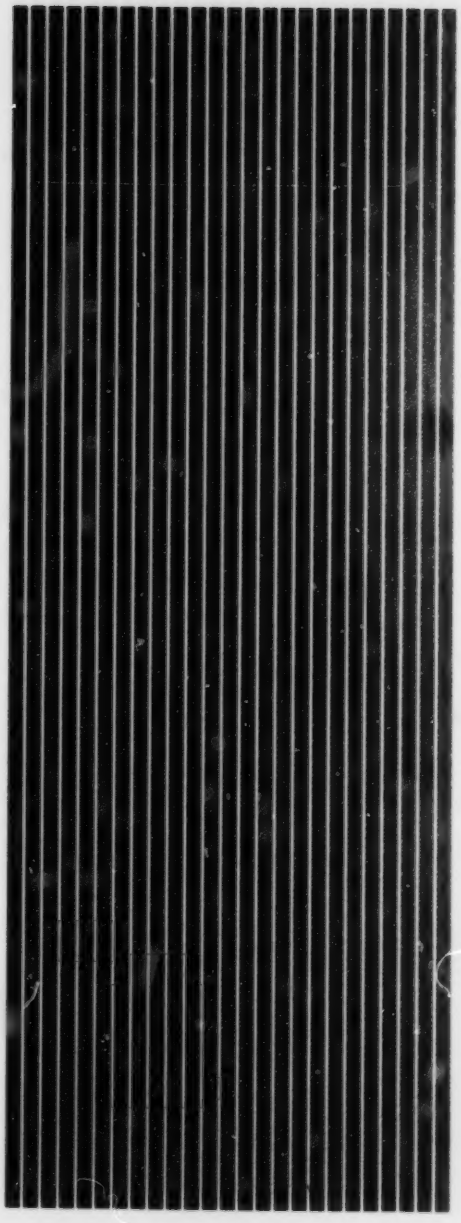

Annual Report 1989/1990

British Columbia Cancer Agency

British Columbia Cancer Research Centre

British Columbia Cancer Foundation

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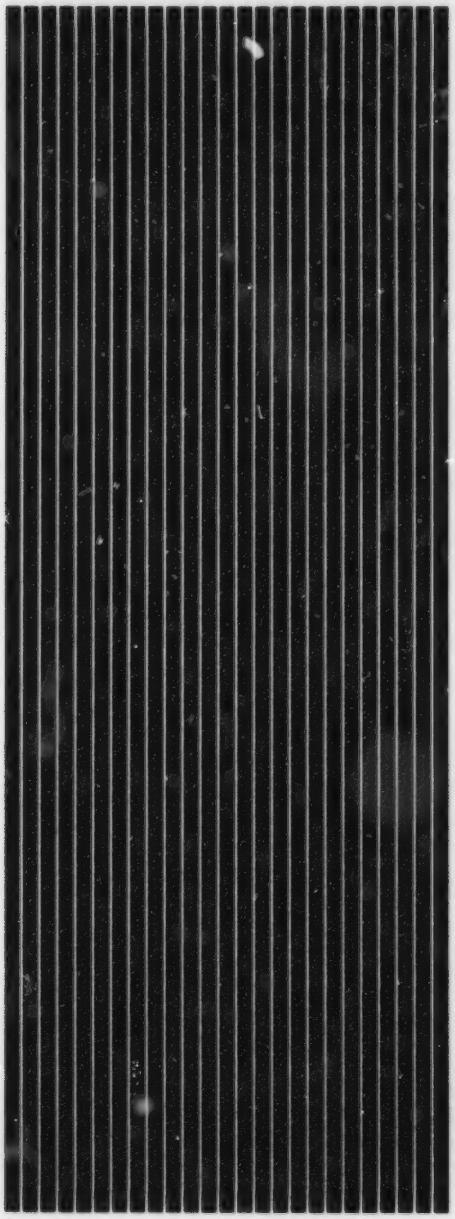
One of the more significant events in the 1989-90 year was the change of name from "Cancer Control Agency of British Columbia" to "British Columbia Cancer Agency". This move took the better part of a year to accomplish because of the many alternatives which were proposed and the exhaustive process of research and discussion which went into the final selection.

The reason for the change was that the old name was confusing and unclear to the public at large. "B.C. Cancer Agency" is simple and specific and aligns the Agency with its sister organizations, the B.C. Cancer Research Centre and the B.C. Cancer Foundation.

The Agency has decided that it will not be identified publicly by its initials BCCA, but rather will utilize the full designation, British Columbia Cancer Agency or B.C. Cancer Agency. For purposes of our Annual Report cover, however, considering the interesting graphic possibilities which it presented, and because it was a name in transition, we note, visually, the change from CCABC to BCCA.



British
Columbia
Cancer
Agency

Administration

Dr. D.J. Klaassen
Director

Mr. B.T. Schmidt
Deputy Director and Chief Operating Officer

Mr. D.C. Richardson
Assistant Deputy Director

Mrs. L.B. Jamieson
Assistant Deputy Director, Nursing and Related Patient Care Services

Dr. D. Osoba
Head, Communities Oncology Program

Dr. P. Coy
Director, Victoria Clinic

Mr. P. McAllister
Administrator, Victoria Clinic

Board of Trustees

Dr. J.H. Chritchley
President

Mrs. J. van Roggen
Vice-President

Mr. J.K. Bull

Mrs. M. Dawson

Mrs. B. Greenlaw

Dr. A.R. Hutchinson

Mr. W.E. Ireland

Mr. L. Jolivet

Mr. V.F. MacLean

Dr. G.I. McGregor

Ms. L.E. Messer

Mr. F.B. Moore

Dr. R.C. Miller, Jr.

Mr. D. Parker

Mr. A.N. Patterson

Mr. B.M. Philp

Mr. T.G. Rust

Board of Trustees Committees and Their Chairmen

Executive Committee
Dr. J.H. Chritchley

Finance Committee
Mr. B.M. Philp

Joint Conference Committee
Mrs. J. van Roggen

Nominating Committee
Mr. L. Jolivet

Professional Advisory Committee
Dr. G.I. McGregor

Quality of Care Committee
Mrs. B. Greenlaw

Ad Hoc Committee on Additional Cancer Facilities
Dr. R.N. Fairey

Ad Hoc Committee on Board Appraisal
Ms. L. Messer

Fund Raising and Public Relations Policy Committee
Chairman not appointed

Ministerial Committees

Joint Agency/Ministry Communities Oncology Program Committee
Mr. D. Wilks

President's Report

Dear Mr. Minister:

This has been a pivotal year for the British Columbia Cancer Agency. Anticipating a 56% increase in the number of cancer patients in British Columbia by the year 2001, the Cabinet of your Government of British Columbia instituted planning for two new full service cancer facilities, one in Surrey by 1994 and the second in the province's interior by 1996. There will be an expansion of the Victoria Clinic by 1996 and our outreach activities will be enhanced to other areas of the province. Construction has already started on a new radiotherapy facility at the A. Maxwell Evans Building, Vancouver Clinic. Because of lack of facilities, equipment and international shortage of radiation technologists and oncologists, the ability of the British Columbia cancer program to cope with its radiotherapy commitments has become progressively strained. Even with night shift operation and rationing radiotherapy treatment to its minimal accepted quality, we have reached the breaking point. We are extremely pleased with your government's response as documented above. However, it would be an omission were this annual report not to recognize, that despite prolonged, indepth and expert planning in 1982, 1987 and 1989, full acceptance of our planning document has met with criticism and resistance. Further, some of the essential premises upon which our cancer treatment services are based have been challenged because of your government's different vision of health care services. The Board of Trustees of the British Columbia Cancer Agency takes this opportunity to fully reassure your government and the people of British Columbia that we will continue to develop cancer treatment facilities over which we can assure excellence of quality of care for our patients.

In common with the rest of the health care system, the cancer program is immersed in a turmoil of change. Our strategic plan process identified to us a peculiar deficiency in profile associated with the Cancer Control Agency of British Columbia. We enjoy enviable national and international reputation as a world leader in innovative cancer treatment and prevention. We are a national role model for our ability to provide cancer treatment to the less populous areas of this province, nevertheless, it was noted with disappointment that we are largely unknown in our own community. Effective February 14, 1990, the Cancer Control Agency of British Columbia was officially renamed the British Columbia Cancer Agency. This corporate name harmonizes appropriately with the British Columbia Cancer Foundation and the British Columbia Cancer Research Centre both of which are physically integrated with our cancer program.

Our capital fund raising program to raise money necessary to upgrade our capital equipment and building projects, has pledges in excess of 1.5 million dollars. A dividend of this capital campaign is the increased community recognition of the size and importance of this province's cancer program and the British Columbia Cancer Agency. Mrs. Barbara Brink has assumed the critical role of chair of the campaign.

It is with pride that we received an excellent survey report from the Canadian Council on Health Facilities Accreditation.

Our reorganized cancer outreach program is renamed the Communities Oncology Program. This program has a responsibility to maintain the quality and availability of cancer medical services outside the major clinics. It is building bridges of cooperation with physicians and hospitals throughout British Columbia and has become a major administrative division of the British Columbia Cancer Agency. Because of this program and our unique cancer treatment manual and our tumour group structure, the physicians and surgeons of this province are kept involved in our cancer program.

The breast cancer screening mammography program, this province's program of early detection of breast cancer, is unique in Canada. The mammography screening facilities are expanding. Physicians in the breast cancer tumour group at the British Columbia Cancer Agency have spearheaded this exciting initiative.

Cancer medicine through the newly created Oncology Program received official recognition by the Faculty of Medicine of the University of British Columbia. Cancer is common. Accepting that one's lifetime chance of developing cancer is one in three, it is critically important that this Agency be involved in the planning and directions of health care personnel training for this province. Understanding cancer diagnosis and treatment taxes almost every facet of biologic knowledge and treatment skill. In order to better prepare health care professionals to cope with the explosion of information and complexities of treatment throughout the cancer related disciplines, we must increasingly emphasize cancer education and research.

It is with immense pride that the British Columbia Cancer Agency records on the occasion of this annual report, the many honours bestowed upon our former Director, Dr. David Boyes. For his dedicated and outstanding contribution to cancer medicine as a physician and surgeon, as a radiotherapist, for the development of the cervical screening program which is the world's first and is the world standard, and for his direction of the Cancer Control Agency of British Columbia. Dr. Boyes has been made an Officer of the Order of Canada. He is now also awarded the rarely bestowed F.N.G. Starr Award, the highest award given to a Canadian physician by the Canadian Medical Association. This tribute is for outstanding and international contribution to world health.

We record that the past year was one of protracted labour dispute but that the strikes did not materially disrupt patient care nor did they diminish the quality of our care. Salary negotiations for our medical and dental staff have been prolonged, arduous and trying. It is with a sense of relief that we report that a satisfactory agreement and funding formula for the treatment physicians is negotiated and that we can now confirm to our medical/dental staff the salary changes promised in good faith more than eighteen months ago. Sadly, no such solution is yet forthcoming for diagnostic physicians.

Both the Vancouver and Victoria Clinics are on the verge of impaired performance because of overcrowding evident in every section and every division. In addition to ambulatory care, medical therapy, radiotherapy, bone marrow transplantation, we also crowd into our facility the teaching programs for medical specialists, medical students, radiotherapy technicians and other students. Nutrition services, cytology, pathology, diagnostic imaging, administration, library services, laboratory and tumour registry are squeezed into one structure. The cancer program is physically unable to cope with the local and provincial demands on its resources for both manpower and space. All these services must expand if we are to achieve our mandate. We are undergoing an organizational review and developing new management strategies in order to accommodate our expanded size and role.

It is again with pride that we note international recognition of many of our physicians and their national and international participation in cancer research in both the Vancouver and Victoria Clinics. $3,717,558 in research grants, supporting 82 personnel, was received by the professional staff of the British Columbia Cancer Agency program.

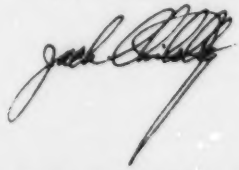
There exists amongst the donor public, considerable confusion regarding the nature and credentials of the many cancer fund raising organizations. Members of the Board of Trustees of the British Columbia Cancer Agency have devoted tireless hours with colleagues from the British Columbia Cancer Foundation and the British Columbia and Yukon Division of the Canadian Cancer Society to forge a unified fund raising agreement. It was noted earlier that the cancer program is enormously complex but we reassert that the treatment program could not achieve many of its aims nor could it provide the same quality of service without our volunteer programs. Our programs lean heavily on the patient care services, the education services and the research grants provided through the fund raising of the Canadian Cancer Society. We additionally received significant support from our own Auxiliary, the Order of the Eastern Star, the IODE and the Free Masons. The contribution of these volunteer groups to the success of our cancer program cannot be overestimated. Our new working partnership with the British Columbia Cancer Foundation and the Canadian Cancer Society will open up new opportunities for our cancer program.

All members of the Board of Trustees of the Cancer Agency are involved in Board committee activities and aspects of inquiry into the cancer program. The Quality of Care Committee is a probing and vigorous committee of our Board. The issues of quality control are so fundamental to the role of the Board of Trustees that all Board members are asked to spend sometime involved in quality of care hearings. Replacing Dr. Morton Low, representative of the Faculty of Science, University of British Columbia, and Mr. Stuart Lang, representative of the British Columbia Cancer Foundation, both of who gave freely of their time and expert counsel, we are pleased to welcome Dr. Robert Miller and Mr. Dale Parker to our Board.

The past year has been a pivotal one for the British Columbia Cancer Agency. Our name is changed and our expanded image marketed throughout the community. We are developing new facilities and planning major cancer treatment capability expansion. We have forged a new working agreement with our Foundation and the Canadian Cancer Society. We have confronted overcrowding and underservicing. We have improved our bonds with the profession and have planned further treatment bridges into the community. We have been in conflict with unions and with our government but we have solved some funding issues and devised new and better management strategies.

The Board of Trustees of the British Columbia Cancer Agency is not daunted by the size of the challenge presented to them and continues to keep in mind the vision of the British Columbia Cancer Agency and to plan the new investigative, diagnostic and treatment environment for cancer services in this province.

Respectfully submitted,



Jack Chritchley, MD, MSc, FRCPC
President and Chairman
Board of Trustees

David J. Klaassen, MD, FRCPC
Director

Volunteer Organizations

IODE

As Chairman of the IODE Jessie R. Burke (Memorial) Cancer and Research Fund Commitee, I am pleased to present this report to the British Columbia Cancer Agency.

During 1989, IODE members spent over 1400 hours serving at the Coffee Bar located across from the Admitting Desk on the first floor. Recently this location has also been the distribution point for certain patients to pick up cases of Ensure and other food supplements recommended to them by the Nutrition Department of the Agency. Donations of $1910.00 received at the Coffee Bar together with Provincial Chapter funds were used to purchase a confidential FAX machine for Health Records. A confidential FAX machine was also purchased for the Victoria Clinic by a Victoria chapter of the IODE. Another Chapter donated funds to purchase a neurostimulator for non-invasive pain control and a portable suction machine for inpatient use, particularly by those undergoing treatment with the new microselectron.

Bonnie Jamieson, Assistant Deputy Director, Nursing and Related Patient Care Services, has been most helpful in directing our members to areas where our assistance can be most helpful. We will endeavour to continue to work along with the special people who staff the Vancouver and Victoria Clinics in their efforts to bring cure, relief and as much comfort as possible to those in their care.

Moira Murdoch
Chairman
Jessie R. Burke (Memorial) Cancer and Research Fund

Order of the Eastern Star

Once again, it is my pleasure to present the report of the Order of the Eastern Star.

The cancer projects approved at the May 1989 Grand Sessions are as follows:

Shane Fellowship - Dr. Thomas Ehlen	$18,000
Closed circuit television	3,571
TENS care kit	546
Cell harvester	5,950
Transvaginal probe	14,471
Three chemotherapy treatment chairs	3,266
Dentistry	
– KAVO headpiece 10:1	205
– KAVO headpiece 1:1	152
– Nobelpharma torque wrench	674
Bottled water drink dispenser	440
Ventriculoscopy equipment	13,780
Moving grid (mammography)	6,042
Olympus viewing attachment for microscope	3,139
MEC TV monitor and receiver Model PR 200-S20"	1,165
Total	**$71,401**

From our British Columbia Cancer Foundation O.E.S. Donation Fund, $11,000 was transferred to help pay for these projects at the British Columbia Cancer Agency and since the hydraulic stretcher was unsuitable and returned, our Cancer Administration Committee agreed to pay the excess of $476.00. All projects are in use and all have been paid.

We have also purchased cancer dressing materials costing $36,740.00, supplying 67 stations and 6 sub-stations. 1048 members worked 23,365 hours making 212,068 total dressings (78,977 have been distributed by the Vancouver Station).

From the Worthy Grand Matron's Special Project, two Beckman tabletop centrifuges and an isolation vibration free table, for the use of Dr. C. Eaves, were purchased costing $17,000.

The Order of the Eastern Star is decidedly happy and grateful for being the recipient of another Cancer Research Award from the British Columbia Cancer Foundation and the British Columbia Cancer Agency. We thank you for the recognition most sincerely and will add it to our Cancer Dressing Contribution Award received from the Canadian Cancer Society.

It has been a pleasure working with all of you and we thank your Executive and staff members for your kindnesses and support.

Lillean Musgrave
Director of Cancer Activities
British Columbia and Yukon Order of the Eastern Star

Committees of the British Columbia Cancer Agency and Their Chairmen

Tumour Group Committees

Bone and Soft Tissue Tumour Group
Dr. C. Beauchamp

Breast Tumour Group
Dr. V.E. Basco

Central Nervous System Tumour Group
Dr. C.M. Ludgate

Gastro-Intestinal Tumour Group
Dr. W.C. MacDonald

Genito-Urinary Tumour Group
Dr. L.D. Sullivan

Gynecology Tumour Group
Dr. J.L. Benedet

Head and Neck Tumour Group
Dr. A.D. Flores

Leukemia Tumour Group
Dr. G.L. Phillips

Lung Tumour Group
Dr. P. Coy

Lymphoma Tumour Group
Dr. J.M. Connors

Melanoma Tumour Group
Dr. H.K.B. Silver

Ocular and Orbital Tumour Group
Dr. J. Rootman

Pediatric Tumour Group
Dr. C.J.H. Fryer

Skin and Skin Lymphoma Tumour Group
Dr. D.I. McLean

Medical/Administrative Committees

Agency Management
Dr. D.J. Klaassen

Bone Marrow Transplant
Dr. G.L. Phillips

Cancer Prevention Advisory
Dr. P.R. Band

Clinical Investigations
Dr. J.M. Connors

Management Advisory
Mr. P. Hayles

Medical Manpower
Dr. D.J. Klaassen

Medical Records
Dr. J.H. Hay

Nutrition
Dr. W.C. MacDonald

Pharmacy and Therapeutics
Dr. I.H. Plenderleith

Professional Advisory Credentials
Dr. G.H. Anderson

Symptom Management
Dr. I.H. Plenderleith

Vancouver Clinic Committees

Biological and Chemical Hazards
Dr. B. Dunn

Infection Control
Dr. F.J. Roberts

Occupational Health and Safety
Mrs. I. Harrison

OR
Dr. R.E. Robins

Patient Care
Drs. J.H. Goldie and S.M. Jackson

Radiation Safety
Mr. D.C. Richardson

Research Management
Dr. D.J. Klaassen

Staff Communications
Mrs. R. Bruce

Victoria Clinic Committees

Department Heads
Mr. P. McAllister

Health Records
Dr. P. Coy

Medical Oncology
Dr. K.S. Wilson

Medical Staff
Dr. P. Coy

Occupational Health and Safety
Ms. H. Chamberlain

Patient Care
Dr. P. Coy

Quality Assurance
Dr. P. Coy

Radiation Therapy
Dr. S. Alexander

Radiotherapy Strategy Committee
Dr. S. Alexander

Division Heads

Clinical Pathology
Dr. A.J. Worth

Cytopathology
Dr. G.H. Anderson

Dentistry
Dr. P. Stevenson-Moore

Dermatologic Oncology
Dr. D.I. McLean

Diagnostic Imaging
Dr. H.A. Mueller

Epidemiology, Biometry and Occupational Oncology
Dr. P.R. Band

Gynecologic Oncology
Dr. J.L. Benedet

Medical Oncology
Dr. J.H. Goldie

- **Section of Advanced Therapeutics**
  Dr. H.K.B. Silver
- **Section of Cancer Endocrinology**
  Dr. N. Bruchovsky

Nursing
Mrs. L.B. Jamieson

Pediatric Oncology
Dr. C.J.H. Fryer

Pharmacy
Mrs. L. Chow

Radiation Oncology
Dr. S.M. Jackson

- **Section of Developmental Radiotherapy**
  Dr. G.B. Goodman

Radiation Physics
Dr. R.O. Kornelsen

Surgical Oncology
Dr. R.E. Robins

Social Work
Mr. R. Doll

Terry Fox Laboratory
Dr. A.C. Eaves

Department Heads

Vancouver Clinic

Admitting
Mrs. H. Hopkins

Ambulatory Care
Mrs. C. Brown

Chaplaincy
Rev. C. Johnstone

Clinical Laboratories
Mr. A. Basi

Cytology Laboratories
Mr. O. Bennett

Data Services
Mr. P. Hayles

Diagnostic Imaging
Mrs. E. Kilby

Distribution Services
Mr. D. Sawyer

Employee Relations
Mrs. R. Bruce

Finance
Mr. D. Morrison

Health Records
Mrs. L. Christian

Hospital 5 West
Mrs. H. Mielcarski

Hospital 5 East
Mrs. B. Korabek

Hospital 6 West
Mrs. J. Walker

Hospital 6 East
Ms. B. McDermott

Library
Mr. D. Noble

Medical Illustration
Mrs. S. Robertson

Mould Room
Mrs. H. Drake

Nutrition and Food Services
Mrs. N. Pellicer

Plant Operations
Mr. S. Young

Prosthetics
Mr. R. Allen

Purchasing
Mr. J. Easton

Radiation Therapy
Mrs. G. Sherstan

Victoria Clinic

Clinical Trials
Mrs. M. Gaunt

Health Records
Mrs. N. Besta

Medical Oncology
Dr. K.S. Wilson

Nursing
Mrs. M. Sauder

Nutrition
Mrs. T. Mushins

Pharmacy
Mr. J. Barnett

Radiation Physics
Dr. D. Linekin

Radiation Oncology
Dr. S. Alexander

Radiotherapy Planning
Mrs. L. Blenkinsop

Radiotherapy Treatment
Ms. M. Stuart

Social Work
Mr. M. Boyle

BC Cancer Agency Professional Staff

Medical, Dental and Scientific Staff

Director
D.J. Klaassen, BA,MD,FRCPC, FACP
Clinical Professor (Medicine)

Clinical Hematology

A.C. Eaves, BSc,MSc,MD, PhD,FRCPC,FACP
Head
Professor (Medicine and Pathology)

M. Barnett, MD,MRCP
Clinical Assistant Professor (Medicine)

D.E. Hogge, MD,PhD,FRCPC
Assistant Professor (Medicine)

R.K. Humphries, BSc,MSc, MD,PhD
Associate Professor (Medicine)

H. Klingemann, MD
Clinical Associate Professor (Medicine)

P.M. Lansdorp, MD,PhD
Clinical Assistant Professor (Medicine)

G. Phillips, MD,ABIM
Professor (Medicine)

D.E. Reece, MD,FRCPC
Clinical Assistant Professor (Medicine)

M. Jancewicz, MD
Clinical Associate

M. Elmongy, MB,ChB
BMT Fellow

A. Grigg, MD
BMT Fellow

T. Nevill, MD
BMT Fellow

M.H. Tirgan, MD
BMT Fellow

Terry Fox Laboratory

A.C. Eaves*
Head

C.J. Eaves, BA,MSc,PhD
Professor (Medical Genetics)

D.E. Hogge*

R.K. Humphries*

D.K. Kalousek, MD,FRCPC, FCCMG
Associate Professor (Pathology)

G. Krystal, BSc,MSc,PhD
Associate Professor (Pathology)

P.M. Lansdorp*

D.L. Mager, BSc,MSc,PhD
Assistant Professor (Medical Genetics)

F. Takei, BSc,PhD
Associate Professor (Pathology)

Clinical Pathology

A.J. Worth, MD,FRCPC
Head
Clinical Professor (Pathology)

R.W. Coupland, MD,FRCPC
Clinical Assistant Professor (Pathology)

R.D. Gascoyne, MD,FRCPC
Clinical Assistant Professor (Pathology)

D.E. Horsman, MD,FRCPC
Clinical Associate Professor (Pathology)

K.G. Lerner, MD,FACP
Clinical Assistant Professor (Pathology)

A. Millner, MD,FRCPC
Clinical Assistant Professor (Pathology)

F.J. Roberts, MD,FRCPC
Clinical Professor (Pathology)

Communities Oncology

D. Osoba, BSc,MD,FRCPC
Head
Clinical Professor (Medicine)

Cytopathology

G.H. Anderson, MB,BS,FRCPC
Head
Clinical Professor (Pathology)

R.W.M. Amy, MD,FRCPC
Clinical Professor (Pathology)

J.C. Le Riche, MB,ChB,FRCPC
Clinical Associate Professor (Pathology)

J.P. Matisic, MD,FRCPC
Clinical Instructor (Pathology)

Dentistry

P. Stevenson-Moore, BDS, LDSRCS,MSD,MRCD(C)
Head
Honorary Assistant Professor (Dentistry)

J.B. Epstein, DMD,MSD
Clinical Assistant Professor (Dentistry)

Dermatologic Oncology

D.I. McLean, BSc,MD,FRCPC
Head
Associate Professor (Medicine)

V.C.Y. Ho, MD,FRCPC
Associate Professor (Medicine)

C. Sigal, MD,FRCPC
Clinical Associate Professor (Medicine)

L.M. Warshawski, MD,FRCPC
Clinical Instructor (Medicine)

Diagnostic Imaging

H.A. Mueller, BA,MD, DABR,FACR
Head
Clinical Professor (Diag Rad)

S.M. Bhimji, MD,ChB,FRCPC
Clinical Assistant Professor (Diag Rad)

D. Harrison, BSc,MD,FRCPC
Clinical Assistant Professor (Diag Rad)

P. Hassell, BSc,MDCM,FRCPC

J. Morgan-Parkes, MD,FRCPC
Clinical Associate Professor (Diag Rad)

Epidemiology, Biometry and Occupational Oncology

P.R. Band, BA,MD,FRCPC
Head
Honorary Professor (Medicine)
Clinical Professor (Health Care & Epi)

T.G. Hislop, BSc,MSc,MD,CM
Clinical Assistant Professor (Health Care & Epi)

A.J. Coldman, BSc,MA,Dip Ep,PhD
Adjunct Professor (Statistics)
Associate Member (Health Care & Epi)

R.P. Gallagher, BSc,MA
Clinical Assistant Professor (Health Care & Epi)
Associate Member (Ophthalmology)

J.J. Spinelli, BSc,MSc
Honorary Lecturer (Health Care & Epi)

M.L. McBride, BA,MSc
Honorary Lecturer (Health Care & Epi)

W.J. Threlfall, BSc,MSc

V.T.Y. Ng, BSc,MMath

L. Kan, BSc,MSc

Gynecologic Oncology

J.L. Benedet, MD,FRCSC
Head
Professor (Obs & Gyne)

B.D. Acker*

P.J. Hoskins*

E.J. McMurtrie, MD,FRCSC
Clinical Instructor (Obs & Gyne)

E. Martin, MD
Clinical Associate

D. Miller, MD,FRCSC
Assistant Professor (Obs & Gyne)

J. Pike, MD
Clinical Associate

K.D. Swenerton*

F. Wong*

M. Turko, MD,FRCSC
Associate Professor (Obs & Gyne)

J. Hamilton, MD
(Resident)

E. Hoyer, MD
(Resident)

P. Wilson, MD
(Resident)

M. Stephenson, MD
(Resident)

Medical Oncology

J.H. Goldie, MD,FRCPC
Head
Clinical Professor (Medicine)

P.R. Band*

N. Bruchovsky*

K. Cadenhead, MD
Clinical Associate

J.M. Connors, MD,ABIM, FRCPC
Clinical Associate Professor (Medicine)

C.M.L. Coppin, BA,MA,BM, BCh,DPhil,MRCP(UK),FRCPC
Clinical Associate Professor (Medicine)

M. Davis, MD,ABIM
(Victoria)

G.W.K. Donaldson, BSc,MB, ChB,MRCP(Edin & London), FRCPC
(Interior Clinic)

K. Gelmon, MD,FRCPC
Clinical Assistant Professor (Medicine)

P.J. Hoskins, BA,MB, MRCP(UK),FRCPC
Clinical Assistant Professor (Medicine)

S. Howdle, BSc,MD,CM,CCFP
Clinical Associate

H. Karsai, MD
Clinical Associate

D.J. Klaassen*

R. Klasa, MD,FRCPC
Clinical Assistant Professor (Medicine)

P. Klimo, MD,ABIM,ABIMO, FRCPC
Clinical Assistant Professor (Medicine)

M.A. Knowling, MD,FRCPC
Clinical Assistant Professor (Medicine)

C. Little, MD,FRCPC
(Victoria)

M. Lymburner, MD,PhD
Clinical Associate

W.C. MacDonald, MD,FRCPC
Associate Professor (Medicine)

O. Marcos, BA,MD
Clinical Associate

K. Murphy, BSc,MD,CM, FRCPC
Clinical Assistant Professor (Medicine)

R.N. Murray, MD,FRCPC
Clinical Associate Professor (Medicine)

S. O'Reilly, BSc,BC,MB,ChB, BAO,MRCP(I),FRCPC
Clinical Associate Professor (Medicine)

D. Osoba*

I.H. Plenderleith, BSc,MD, FRCPC
Clinical Professor (Medicine)

J. Ragaz, MD,LRCP,MRCS, FRCPC
Clinical Associate Professor (Medicine)

D. Ripley, MD
Clinical Associate (Victoria)

L. Saretsky, MD

A.M. Shah, BSc,MD,CM, FRCPC
Clinical Associate Professor (Medicine)

H.K.B. Silver*

D.S. Stuart, MD,FRCPC
Clinical Assistant Professor (Medicine)

K.D. Swenerton, MD,FRCPC
Clinical Associate Professor (Medicine)

K.S. Wilson, MB,FRCP(Edin), FRCPC,FACP
(Victoria)
Clinical Assistant Professor (Medicine)

A. Lohri, MD
(Fellow)

C. Berube, MD
(Resident)

C. Bryce, MD
(Resident)

P. Dejardins, MD
(Resident)

D. Holland, MD
(Resident)

R. McCroskey, MD
(Resident)

M. McLaughlin, MD,FRCP, ABIM
(Resident)

B. Samson, MD
(Resident)

Section of Advanced Therapeutics

H.K.B. Silver, BSc,MD,PhD, FRCPC,FACP
Head
Clinical Professor (Medicine)

S.R. Dedhar, BSc,MSc,PhD
Assistant Professor (Pathology)

L. Embree, BSc(Pharm),MSc, PhD

J.H. Goldie*

F.A. Salinas, BSc,DVM
Clinical Professor (Pathology)

Section of Cancer Endocrinology

N. Bruchovsky, MD,FRCPC, PhD
Head
Honorary Professor (Medicine)

C.T. Beer, FRIC,DPhil(Oxford)
Professor Emeritus (Biochemistry)
Honorary Member, BCCA Professional Staff

S.L. Goldenberg, MD,FRCSC

P.W. Gout, PhD
Honorary Associate Professor (Surgery)

E.C. Jones, MD,FRCPC

R.L. Noble, OC,MD,PhD,DSc (London),FRSC
Professor Emeritus (Physiology)
Honorary Member, BCCA Professional Staff

P.S. Rennie, PhD
Honorary Professor (Surgery)

Nursing

M. Deschamps, RN,BScN, MSc(A) Nursing, PhD Community Health (Epidemiology)
Adjunct Faculty
(School of Nursing, UBC)

Pain Service

B. Allen, MD,FRCPC

Pediatric Oncology

C.J.H. Fryer, LRCP,MRCS, DMRT,FRCPC
Head
Clinical Associate Professor (Ped)

K.W. Chan, MB,FRCPC
Assistant Professor (PT)(Ped)

S.L. Pritchard, BM,BS,FRCPC
Assistant Professor (Ped)

P.C.J. Rogers, MB,MRCP(UK), FRCPC
Associate Professor (Ped)
Head, Division of Pediatric Hematology/Oncology UBC & BCCH

J.M. Teasdale, MD,ChB, FRCPC
Associate Professor (Ped)

Radiation Oncology

S.M. Jackson, MB,ChB,MD (Manchester),DMRT,FRCR, FRCPC
Head
Clinical Professor (Surgery)

B.D. Acker, BSc(Hon),MD, DABR,FRCPC
Clinical Assistant Professor (Surgery)

S. Alexander, MB,BS,LRCP, MRCS,DMRT,DABR(T),FRCR, FRCPC
(Victoria)

V.E. Basco, MB,ChB,DMRT, FRCR,FRCPC
Clinical Professor (Surgery)

J.L. Bowen, MD,FRCPC
Locum Radiation Oncologist (Victoria)

E. Cairns, MD
Clinical Associate

P. Coy, MB,ChB,DMRT,FRCPC
(Victoria)
Clinical Assistant Professor (Surgery)

G.G. Duncan, BSc,MB,ChB, MRCP(UK),FRCPC
Clinical Assistant Professor (Surgery)

R.N. Fairey, BSc (Hon Zoology),MD,FRCPC
Clinical Associate Professor (Surgery)

A.D. Flores, BSc,MD,MB, FRCPC
Clinical Associate Professor (Surgery)

C.J.H. Fryer*

K.J. Goddard, BSc,MB,ChB, MRCP(UK),FRCPC
Clinical Instructor

G.B. Goodman*

C. Grafton, MB,BS,MRCS, MRCP,FRCR,FRCPC,PhD
Clinical Assistant Professor (Surgery)

J.H. Hay, BA,MA,MB,BChir, DCH,MRCP(UK),DMRT,FRCR, FRCPC
Clinical Assistant Professor (Surgery)

W.Y.V. Leung Lam, BA,MD
Clinical Associate

C.M. Ludgate, MB,ChB,MD, FRCSE,DMRT,FRCPC
(Victoria)
Clinical Associate Professor (Surgery)

J.L. Matheson, BA,MD
Clinical Associate

M.F. Manji, MB,ChB,DMRT, MD,DABR,FRCPC
Clinical Associate Professor (Surgery)

G. Newman, MB,ChB,MRCP, FRCR
Clinical Fellow

I.A. Olivotto, BSc(Zoology), MD,FRCPC
Clinical Assistant Professor (Surgery)

D.E. Rheaume, BSc(Hon Biology),MSc,MD,FRCPC
Clinical Instructor (Surgery)

N.J.S. Voss, LRCP,MRCS, DMRT,FRCR,FRCPC
Clinical Associate Professor (Surgery)

F.L-W. Wong, BSc (Hon Biochem),MD,FRCPC
Clinical Assistant Professor (Surgery)

S.J. Fitzpatrick, BSc,MD
(Resident)

C. Kim-Sing, MB,ChB,MD
(Resident)

E.N. Loewen, BSc,MEd,MD
(Resident)

M.M. McKenzie, BSc,MD
(Resident)

W.J. Morris, BSc,MSc,MD
(Resident)

C. Parsons, MD,CCFP
(Resident)

P. Selke, MD,FRCSC (Obs/Gyn)
(Resident)

V. Tsang, MB,ChB
(Resident)

Section of Developmental Radiotherapy

G.B. Goodman, MB,ChB, DMRT,FRCPC,FRCP(Edin), FRCR,FACR
Head
Clinical Professor (Surgery)

T.A. Pickles, MB,BSc,MRCP (UK),FRCR
Clinical Fellow - TRIUMF

Y. Takai, MD,PhD
Clinical Fellow - TRIUMF

Radiation Physics

R.O. Kornelsen, BSc,MSc, PhD,FCCPM
Head
Honorary Lecturer

R.W. Harrison, BSc,MSc

S.G. Hussein, BSc,MSc,PhD, FCCPM

G.M. Kennelly, BSc,FCCPM

W.S.Y. Kwa, BSc,MSc, MCCPM

G.K.Y. Lam, BSc,PhD
Honorary Assistant Professor

D.M. Linekin, BSc,MSc,PhD
(Victoria)

L.J. Watts, BSc,MSc

K.F.K. Yuen, BSc,MSc,PhD

Surgical Oncology

R.E. Robins, MD,FRCSC
Head
Clinical Professor (Surgery)

Senior Allied Professional Staff

L. Chow, BSc(Pharm)

R. Doll, MSW,MSC
Field Instructor (Social Work)

L.B. Jamieson, RN,BScN,MBA

Rev. C. Johnstone, BA,BD, ThM
Adjunct Faculty (Vancouver School of Theology)

P. McAllister, BA,Dip HSA, CHE

D. Noble, BSc,BLS

D.C. Richardson, BComm, CHE

B.T. Schmidt, OD,MSc,CHE
Clinical Associate Professor (Health Care and Epi)

*Academic credentials and clinical appointments noted elsewhere.

Five-Year Financial Highlights

	1989/90	1988/89	1987/88	1986/87	1985/86
	$ 000	$ 000	$ 000	$ 000	$ 000
Expenditures					
The increase in total expenditures over the past five years shows the growing role of the Agency in assuming financial responsibility for cancer care in the province.					
Operating Fund	**$65,827**	$59,578	$55,240	$50,303	$45,156
Screening Mammography Program*	**940**	371	–	–	–
Investigative Grants Fund	**3,807**	3,082	3,134	2,914	2,206
Plant Fund	**10,291**	1,566	1,345	6,508	2,705
Total Expenditures	**$80,865**	$64,597	$59,719	$59,725	$50,067
Net Operating Results					
The deficits for the immediately preceding years were incurred as planned to utilize the accumulated surplus from previous years.					
Excess (Deficiency) of Operating Fund revenue over expenditure for the year	**$ 47**	$ (16)	$ (380)	$ (1,080)	$ (1,274)
% of Operating Fund expenditure	**0.0%**	(0.0%)	(0.7%)	(2.3%)	(2.8%)

*Screening Mammography Program

The Screening Mammography Program of B.C. commenced in July 1988 with a stand-alone clinic operated by the Agency as a pilot site, with the expectation of an eventual province-wide network of clinics to be operated by an independent society.

**Plant Fund

During 1989/90, title to the land upon which the Agency's Vancouver Clinic is located was transferred to the Agency by the Province of B.C. The land has been recorded at its estimated fair market value at the time of its transfer.

Condensed Statements of Revenue, Expenditure and Surplus

For the year ended March 31, 1990
with comparative figures for the
year ended March 31, 1989

		1990 $ 000	1989 $ 000
Operating Fund			
Revenue	Government grants	**$62,096**	$56,068
	Recoveries for services	**2,798**	2,588
	Investment and other income	**980**	906
		65,874	59,562
Expenditure	Salaries, wages and benefits	**45,345**	40,523
	Patient care	**14,008**	13,136
	Plant and support services	**6,474**	5,919
		65,827	59,578
Current year's excess (deficiency) of revenue over expenditure		**47**	(16)
Surplus, beginning of year		**616**	632
Surplus, end of year		**$ 663**	$ 616
Plant Fund			
Surplus, beginning of year		**$41,946**	$43,286
Add: Capital grants received		**10,291**	1,565
		52,237	44,851
Deduct: Depreciation		**(2,978)**	(2,905)
Surplus, end of year		**$49,259**	$41,946

The information shown in the condensed financial statements is extracted from the Agency's full financial statements for the year ended March 31, 1990 on which the Agency's auditors, Ernst & Young, have reported. Copies of their report and of the full financial statements are available on request.

Financial Statements

Condensed Balance Sheets

as at March 31, 1990
with comparative figures as at
March 31, 1989

		1990 $ 000	1989 $ 000
Assets	Cash	$ 3,044	$ 2,900
	Amounts receivable	3,584	1,877
	Inventory of supplies & prepaid expenses	1,159	1,238
		$ 7,787	$ 6,015
	Buildings and equipment	49,259	41,946
		$57,046	$47,961
Liabilities	Accounts payable and accruals	$ 7,124	$ 5,399
Surplus	Operating fund	663	616
	Plant fund	49,259	41,946
		$57,046	$47,961

The information shown in the condensed financial statements is extracted from the Agency's full financial statements for the year ended March 31, 1990 on which the Agency's auditors, Ernst & Young, have reported. Copies of their report and of the full financial statements are available on request.

Patient Statistics

	April 89 – March 90			April 88 – March 89		
	Vancouver Clinic	Victoria Clinic	Community Oncology Clinics	Vancouver Clinic	Victoria Clinic	Community Oncology Clinics
New Patient examinations (including second sites)	5,857	1,438	493*	6,215	1,412	815
Treatments: Radiation						
Patients completed – All modalities	5,327	1,346	–	5,239	1,343	–
Fields treated						
X-rays and cobalt	134,245	36,324	–	132,450	34,820	–
Radium and caesium	470	38	–	471	54	–
Other	–	–	–			–
Total	134,715	36,362	–	132,921	34,874	–
Patient visits	65,654	18,271	–	59,770	16,115	–
Treatments: Chemotherapy						
Patients started	6,596	N/A	–	6,308	N/A	–
Patient visits	10,821	2,187	–	9,972	2,199	–
Other Ambulatory Care Visits	35,326	9,076	5,235	36,378	7,922	5,516

N/A Not Available

* A new classification system was introduced in 1989/90

Number of Referred Cases to the Vancouver and Victoria Clinics

January – December 1989

Site/Histology	Vancouver	Victoria
BREAST	1,263	336
ENDOCRINE GLANDS		
Thyroid Gland	55	15
Other Endocrine Glands	7	0
GASTROINTESTINAL		
Colon	211	73
Esophagus	77	14
Gallbladder & Biliary Tract	17	3
Liver	27	2
Pancreas	77	13
Rectum, Rectosigmoid & Anus	229	56
Small Intestine	5	2
Stomach	110	11
GENITOURINARY		
Kidney, Ureter, Urethra	102	20
Penis & Other Male Genital Organs	11	1
Prostate	692	167
Testicle	79	12
Urinary Bladder	144	18
GYNECOLOGY		
Cervix Uteri	114	13
Corpus Uteri (Endometrium, Myometrium)	217	41
Ovary, Fallopian Tube & Broad Ligament	137	30
Placenta (Hydatiform Mole)	3	2
Other & Unspecified Female Genital Organs	38	5

Site/Histology	Vancouver	Victoria
HEAD & NECK		
Eye & Lacrimal Gland	6	0
Larynx	98	23
Lip	21	1
Mouth	102	23
Nasal Cavities	20	1
Pharynx	101	20
Salivary Glands	17	4
LUNG, THYMUS, HEART & MEDIASTINUM		
Trachea, Bronchus & Lung	899	291
Thymus, Heart & Mediastinum	10	2
PRIMARY UNKNOWN	150	35
RETROPERITONEUM	5	0
SKIN	338	85
CENTRAL NERVOUS SYSTEM		
Brain	124	25
Other & Unspecified Parts of the Nervous System	9	1
MALIGNANT MELANOMA	291	40
MESOTHELIOMAS	12	4
RETICULOENDOTHELIAL & HEMATOPOIETIC SYSTEMS		
Hodgkin's Disease	80	13
Leukemia	110	22
Multiple Myeloma	47	21
Non-Hodgkin's Disease	300	73
Other Malignant & Borderline Diseases of the Reticuloendothelial & Hematopoietic Systems	23	3
SARCOMA		
Bones, Joints, Articular Cartilage, Connective Subcutaneous & Soft Tissue	116	16
Kaposi's Sarcoma	31	2
NON-CANCER	200	19
MISCELLANEOUS	1	2
TOTALS	6,726	1,560
YOUTH CANCERS (included in above breakdown)	140	2

Ten Most Frequent Types of Cancer

(by Sex and Age Group)

Referred to the Vancouver Clinic in 1989

	0-16		17-24		25-34		35-44		45-54		55-64		65-74		75-84		85+		TOTAL		GRAND
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	TOTAL
Breast	0	0	1	0	44	0	194	0	232	1	291	2	310	3	164	1	20	0	1256	7	1263
Lung, Thymus, Heart & Mediastinum	0	0	0	0	3	2	20	14	47	49	81	153	135	213	51	112	6	13	343	556	899
Prostate	—	0	—	0	—	0	—	0	—	17	—	139	—	329	—	191	—	16	—	692	692
Skin	0	0	0	0	4	1	8	10	12	24	15	37	44	60	49	42	19	13	151	187	338
Non-Hodgkin's Disease	3	6	2	4	10	14	9	18	22	26	22	36	40	38	20	23	5	2	133	167	300
Malignant Melanoma	0	0	11	3	19	17	31	26	17	35	20	38	22	21	11	12	5	3	136	155	291
Rectum, Rectosigmoid, & Anus	0	0	0	0	2	2	10	8	12	19	21	45	27	54	11	17	1	0	84	145	229
Corpus Uteri	0	—	0	—	1	—	11	—	27	—	56	—	80	—	31	—	11	—	217	—	217
Colon	0	0	0	0	0	0	7	5	15	15	27	20	48	42	15	13	4	0	116	95	211
Primary Unknown	0	0	0	0	0	0	3	2	17	13	14	25	18	25	15	11	2	5	69	81	150
TOTALS	3	6	14	7	83	36	293	83	401	199	547	495	724	785	367	422	73	52	2505	2085	4590
	9		21		119		376		600		1042		1509		789		125		4590		

Referred to the Victoria Clinic in 1989

	0-16		17-24		25-34		35-44		45-54		55-64		65-74		75-84		85+		TOTAL		GRAND
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	TOTAL
Breast	0	0	0	0	11	0	26	0	58	0	88	0	97	0	45	0	11	0	336	0	336
Lung, Thymus, Heart & Mediastinum	0	0	0	0	0	0	3	3	9	10	25	51	41	80	20	42	2	5	100	191	291
Prostate	—	0	—	0	—	0	—	0	—	3	—	35	—	102	—	27	—	0	—	167	167
Skin	0	0	1	1	1	0	0	0	2	1	4	8	12	14	8	21	4	8	32	53	85
Colon	0	0	0	0	0	0	2	0	5	4	9	16	15	13	4	4	1	0	36	37	73
Non-Hodgkin's Disease	0	1	1	0	0	2	1	2	6	3	8	11	14	9	6	5	3	1	39	34	73
Rectum, Rectosigmoid, & Anus	0	0	0	0	1	0	1	2	1	3	5	8	6	13	4	10	1	1	19	37	56
Corpus Uteri	0	—	0	—	1	—	0	—	5	—	10	—	16	—	9	—	0	—	41	—	41
Malignant Melanoma	0	0	0	1	1	0	2	1	6	2	4	5	7	8	1	1	0	1	21	19	40
Primary Unknown	0	0	0	0	1	0	0	0	1	2	2	4	9	9	3	3	1	0	17	18	35
TOTALS	0	1	2	2	16	2	35	8	93	28	155	138	217	248	100	113	23	16	641	556	1197
	1		4		18		43		121		293		465		213		39		1197		

B.C. Cancer Statistics 1988

This section presents incidence and mortality data for cancer in British Columbia in 1988, and data on trends in incidence and mortality of cancer in the province.

Long term trends in the frequency of cancer in British Columbia are presented in graph form on page 17. The number of new cases of cancer diagnosed each year is increasing by approximately 4% per year, due to changes in the size and age structure of the population. However, the age-standardized incidence rate[1], adjusted to compensate for changes in the age composition of the population over time, has been relatively stable. Over the last three years, there is an apparent increase in the overall standardized incidence rate of cancer in British Columbia, but further data are necessary before we know whether or not this is a real change.

Age-, sex-, and site-specific tables of the number and crude incidence rates of new primary invasive cancers diagnosed among residents of the province in 1988 are included on pages 18-19, as well as pie charts of relative frequency of new cancer cases according to anatomic site and sex on page 21. The relative frequency of childhood cancers are presented separately. Corresponding tables and charts for cancer deaths among B.C. residents in 1988 are also presented. The age-standardized incidence and mortality rates for cancer by sex and anatomic site for the last five years are shown on pages 20 and 24. There are minor differences in rates between this table and those published in earlier years, due to new information becoming available.

There are several cancer sites which are of particular interest:

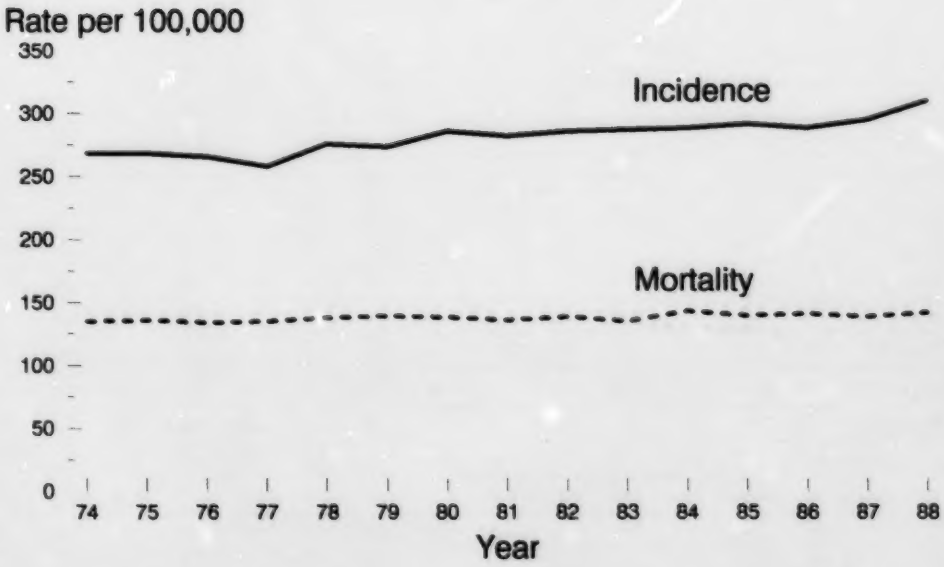
1) the number of cases of cancer of the floor of the mouth has been rising recently in men only, as have pancreatic cancer cases in women. These changes may be due to random fluctuation as relatively small numbers of cases are involved.
2) the increases in lung cancer cases are the same in absolute terms in both men and women (approximately 50 additional cases per year); however, the rate of increase is twice as high in women, due to their lower baseline rate.
3) melanoma rates are continuing to rise significantly in both men and women, as expected, because of changes in individuals' sun exposure in recent years.
4) prostate cancer rates are continuing to increase, at least partly due to increased detection and reporting of this disease.
5) there has been a large jump in the number of female breast cancer cases diagnosed in 1988, compared to previous years. The most likely explanation for this change is the heightened awareness of the effectiveness of breast cancer screening.

This information has been compiled from data available in the Cancer Registry.

1 Age-standardized rates adjusted to the 1971 Canadian population

Frequency of New Cancers and Cancer Deaths in B.C., [1] 1974-1988 Male and Female Combined

Age-Standardized Cancer Incidence and Mortality Rates in B.C., [1] 1974-1988 Male and Female Combined



[1] Excludes non-melanoma skin cancers.

B.C. Cancer Statistics 1988

New Cancer Primaries by Sex and Age-Group

	0 - 34		35 - 44		45 - 54		55 - 64		65 - 74		75 - 84		85 - UP		TOTAL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip	2	1	3	0	4	0	5	1	14	6	5	3	5	2	38	13
Tongue	2	0	4	1	8	2	12	4	11	4	6	2	1	3	44	16
Mouth	3	3	5	2	13	6	30	7	22	12	7	4	0	5	80	39
Pharynx	6	2	10	0	13	4	40	5	15	6	9	3	1	0	94	20
Esophagus	0	0	2	0	8	4	22	7	27	15	24	13	4	5	87	44
Stomach	2	1	8	5	19	4	40	17	71	34	63	47	18	14	221	122
Small Intestine	1	0	1	0	2	2	2	1	5	3	3	3	1	1	15	10
Colon	0	3	12	16	20	30	68	68	154	169	131	146	28	78	413	510
Rectum	1	0	12	16	29	20	75	54	129	79	85	65	10	27	341	261
Liver	3	2	3	0	7	3	7	4	25	12	18	9	7	8	70	38
Gallbladder	1	0	0	0	2	3	12	6	13	9	9	15	2	12	39	45
Pancreas	1	1	1	4	4	10	36	31	52	51	48	61	16	22	158	180
Larynx	0	0	2	0	12	1	38	7	38	3	16	3	4	0	110	14
Trachea, Bronchus, Lung	2	2	13	15	90	65	319	166	466	240	284	164	56	43	1230	695
Bone, Connective Tissue	12	12	3	2	4	1	10	3	14	6	2	8	4	3	49	35
Melanoma-Skin	35	44	30	48	29	43	43	37	54	34	19	26	7	10	217	242
Other Skin	76	93	215	202	321	280	652	494	918	649	596	523	170	219	2948	2460
Breast	1	46	1	202	1	323	0	433	3	511	3	304	0	107	9	1926
Cervix	—	25	—	33	—	18	—	22	—	19	—	11	—	7	—	135
Uterus	—	1	—	19	—	43	—	94	—	144	—	55	—	18	—	374
Ovary	—	17	—	20	—	34	—	44	—	79	—	50	—	16	—	260
Other Female Genital Organs	—	1	—	2	—	0	—	5	—	10	—	5	—	8	—	31
Prostate	1	—	2	—	28	—	286	—	696	—	556	—	156	—	1725	—
Testis	38	—	24	—	5	—	4	—	1	—	0	—	0	—	72	—
Bladder	2	2	8	3	20	2	57	13	94	34	81	27	19	18	281	99
Kidney	4	6	8	3	28	8	57	14	59	34	43	23	8	6	207	94
Brain	24	18	6	5	27	9	24	15	28	18	14	10	1	4	124	79
Thyroid	7	21	7	19	4	10	7	12	6	16	2	7	2	0	35	85
Non-Hodgkin's Lymphoma	26	13	28	13	29	18	38	28	79	58	53	43	12	15	265	188
Hodgkin's Disease	18	18	7	0	4	2	6	2	6	3	1	1	0	0	42	26
Multiple Myeloma	1	0	2	1	4	3	17	14	36	25	25	28	8	7	93	78
Leukemia: Acute Lymphatic	17	13	1	0	3	1	0	1	2	0	1	0	0	1	24	16
Chronic Lymphatic	0	0	0	0	6	2	12	6	19	10	17	9	6	11	60	38
Acute Granulocytic	3	3	6	2	2	0	1	5	8	4	4	5	4	1	28	20
Chronic Granulocytic	3	3	4	6	1	3	2	3	10	5	7	6	1	0	28	26
Other & Unspecified	2	4	0	3	2	0	7	2	7	7	10	9	4	6	32	31
Other Primary Sites	16	7	5	4	16	9	31	13	24	16	25	18	8	15	125	82
Unknown & Ill-Defined Sites	3	0	5	9	9	17	32	35	66	75	50	50	20	37	185	223
TOTAL	313	362	438	655	774	980	1992	1673	3172	2400	2217	1756	583	729	9489	8555

B.C. Cancer Statistics 1988

Incidence Rates (per 100,000) by Sex and Age-Group

	0 - 34		35 - 44		45 - 54		55 - 64		65 - 74		75 - 84		85 - UP		TOTAL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip	0.3	0.1	1.3	0.0	2.5	0.0	3.6	0.7	13.4	4.7	10.2	4.4	47.6	9.2	2.6	0.9
Tongue	0.3	0.0	1.7	0.4	5.0	1.3	8.6	2.8	10.5	3.1	12.3	3.0	9.5	13.8	3.0	1.1
Mouth	0.4	0.4	2.2	0.9	8.2	3.9	21.5	4.9	21.0	9.4	14.3	5.9	0.0	22.9	5.4	2.6
Pharynx	0.8	0.3	4.3	0.0	8.2	2.6	28.7	3.5	14.3	4.7	18.4	4.4	9.5	0.0	6.4	1.3
Esophagus	0.0	0.0	0.9	0.0	5.0	2.6	15.8	4.9	25.8	11.8	49.1	19.2	38.1	22.9	5.9	2.9
Stomach	0.3	0.1	3.5	2.2	12.0	2.6	28.7	12.0	67.9	26.7	128.8	69.4	171.4	64.2	15.0	8.1
Small Intestine	0.1	0.0	0.4	0.0	1.3	1.3	1.4	0.7	4.8	2.4	6.1	4.4	9.5	4.6	1.0	0.7
Colon	0.0	0.4	5.2	7.0	12.6	19.5	48.7	47.9	147.2	132.9	267.9	215.7	266.7	357.8	28.0	33.8
Rectum	0.1	0.0	5.2	7.0	18.3	13.0	53.8	38.1	123.3	62.1	173.8	96.0	95.2	123.9	23.1	17.3
Liver	0.4	0.3	1.3	0.0	4.4	2.0	5.0	2.8	23.9	9.4	36.8	13.3	66.7	36.7	4.7	2.5
Gallbladder	0.1	0.0	0.0	0.0	1.3	2.0	8.6	4.2	12.4	7.1	18.4	22.2	19.0	55.0	2.6	3.0
Pancreas	0.1	0.1	0.4	1.7	2.5	6.5	25.8	21.8	49.7	40.1	98.2	90.1	152.4	100.9	10.7	11.9
Larynx	0.0	0.0	0.9	0.0	7.6	0.7	27.2	4.9	36.3	2.4	32.7	4.4	38.1	0.0	7.5	0.9
Trachea, Bronchus, Lung	0.3	0.3	5.6	6.5	56.8	42.3	228.7	117.0	445.5	188.7	580.8	242.2	533.3	197.2	83.3	46.1
Bone, Connective Tissue	1.5	1.6	1.3	0.9	2.5	0.7	7.2	2.1	13.4	4.7	4.1	11.8	38.1	13.8	3.3	2.3
Melanoma-Skin	4.5	5.7	12.9	20.9	18.3	28.0	30.8	26.1	51.6	26.7	38.9	38.4	66.7	45.9	14.7	16.0
Other Skin	9.7	12.1	92.8	88.1	202.5	182.3	467.4	348.1	877.6	510.2	1218.8	772.5	1619.0	1004.6	199.7	163.1
Breast	0.1	6.0	0.4	88.1	0.6	210.3	0.0	305.1	2.9	401.7	6.1	449.0	0.0	490.8	0.6	127.7
Cervix	—	3.3	—	14.4	—	11.7	—	15.5	—	14.9	—	16.2	—	32.1	—	9.0
Uterus	—	0.1	—	8.3	—	28.0	—	66.2	—	113.2	—	81.2	—	82.6	—	24.8
Ovary	—	2.2	—	8.7	—	22.1	—	31.0	—	62.1	—	73.9	—	73.4	—	17.2
Other Female Genital Organs	—	0.1	—	0.9	—	0.0	—	3.5	—	7.9	—	7.4	—	36.7	—	2.1
Prostate	0.1	—	0.9	—	17.7	—	205.0	—	665.4	—	1137.0	—	1485.7	—	116.9	—
Testis	4.9	—	10.4	—	3.2	—	2.9	—	1.0	—	0.0	—	0.0	—	4.9	—
Bladder	0.3	0.3	3.5	1.3	12.6	1.3	40.9	9.2	89.9	26.7	165.6	39.9	181.0	82.6	19.0	6.6
Kidney	0.5	0.8	3.5	1.3	17.7	5.2	40.9	9.9	56.4	26.7	87.9	34.0	76.2	27.5	14.0	6.2
Brain	3.1	2.3	2.6	2.2	17.0	5.9	17.2	10.6	26.8	14.2	28.6	14.8	9.5	18.3	8.4	5.2
Thyroid	0.9	2.7	3.0	8.3	2.5	6.5	5.0	8.5	5.7	12.6	4.1	10.3	19.0	0.0	2.4	5.6
Non-Hodgkin's Lymphoma	3.3	1.7	12.1	5.7	18.3	11.7	27.2	19.7	75.5	45.6	108.4	63.5	114.3	68.8	18.0	12.5
Hodgkin's Disease	2.3	2.3	3.0	0.0	2.5	1.3	4.3	1.4	5.7	2.4	2.0	1.5	0.0	0.0	2.8	1.7
Multiple Myeloma	0.1	0.0	0.9	0.4	2.5	2.0	12.2	9.9	34.4	19.7	51.1	41.4	76.2	32.1	6.3	5.2
Leukemia: Acute Lymphatic	2.2	1.7	0.4	0.0	1.9	0.7	0.0	0.7	1.9	0.0	2.0	0.0	0.0	4.6	1.6	1.1
Chronic Lymphatic	0.0	0.0	0.0	0.0	3.8	1.3	8.6	4.2	18.2	7.9	34.8	13.3	57.1	50.5	4.1	2.5
Acute Granulocytic	0.4	0.4	2.6	0.9	1.3	0.0	0.7	3.5	7.6	3.1	8.2	7.4	38.1	4.6	1.9	1.3
Chronic Granulocytic	0.4	0.4	1.7	2.6	0.6	2.0	1.4	2.1	9.6	3.9	14.3	8.9	9.5	0.0	1.9	1.7
Other & Unspecified	0.3	0.5	0.0	1.3	1.3	0.0	5.0	1.4	6.7	5.5	20.4	13.3	38.1	27.5	2.2	2.1
Other Primary Sites	2.0	0.9	2.2	1.7	10.1	5.9	22.2	9.2	22.9	12.6	51.1	26.6	76.2	68.8	8.5	5.4
Unknown & Ill-Defined Sites	0.4	0.0	2.2	3.9	5.7	11.1	22.9	24.7	63.1	59.0	102.2	73.9	190.5	169.7	12.5	14.8
TOTAL	40.0	47.2	189.0	285.5	488.3	638.0	1428.0	1179.0	3032.5	1886.8	4533.7	2593.8	5552.4	3344.0	642.8	567.3

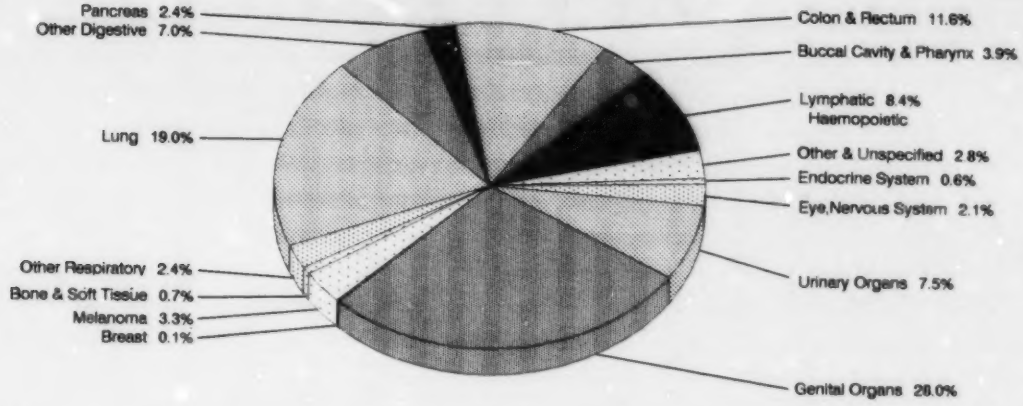
B.C. Cancer Statistics 1988

Age Standardized Incidence (per 100,000) by Sex

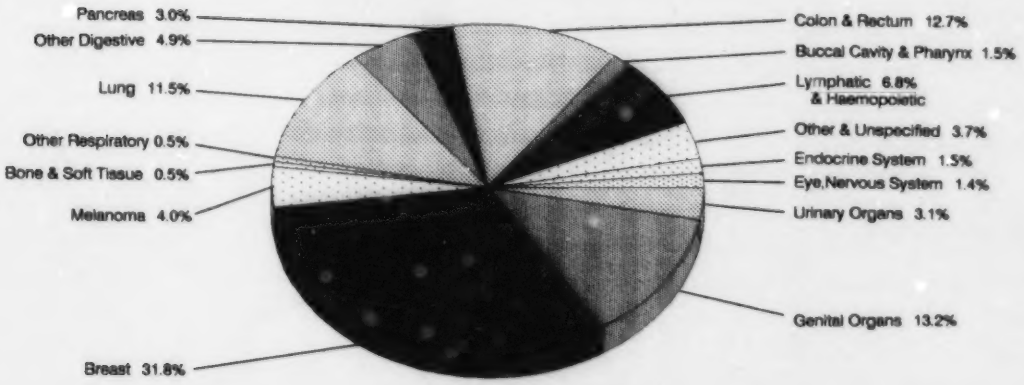
	Male					Female				
	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
Lip	3.0	2.8	2.5	1.8	1.9	0.4	0.7	0.4	0.5	0.6
Tongue	2.3	1.7	1.8	1.7	2.3	1.4	1.3	1.0	1.0	0.8
Mouth	3.7	3.5	2.9	3.3	4.3	2.0	2.7	1.5	2.5	1.9
Pharynx	4.1	4.3	4.2	4.0	5.1	1.7	1.7	1.5	1.9	1.1
Esophagus	4.2	4.5	4.6	4.4	4.3	1.7	2.1	1.5	1.7	2.0
Stomach	10.7	11.7	10.5	10.3	10.7	5.0	6.5	5.7	5.7	5.4
Small Intestine	1.1	0.8	1.1	0.8	0.7	0.6	0.8	0.6	0.5	0.5
Colon	23.9	25.6	24.3	25.4	19.5	25.8	25.2	24.2	21.8	22.9
Rectum	17.3	17.7	17.8	18.2	16.5	13.1	14.8	13.0	12.9	12.2
Liver	2.6	2.9	4.1	3.3	3.4	1.5	1.6	1.8	1.5	1.7
Gallbladder	1.6	1.3	1.9	1.5	1.9	2.2	2.0	2.6	3.2	2.0
Pancreas	7.8	8.3	8.3	7.4	7.6	5.9	6.1	6.0	7.6	8.2
Larynx	5.1	4.3	5.0	5.3	5.6	1.2	0.5	0.4	0.9	0.7
Trachea, Bronchus, Lung	60.1	60.5	58.7	59.1	60.0	30.1	27.8	30.9	32.5	33.3
Bone, Connective Tissue	2.5	3.5	3.0	1.6	2.8	2.5	1.3	2.4	2.2	2.0
Melanoma-Skin	8.1	10.6	9.4	10.4	11.5	9.4	12.8	10.3	11.1	12.8
Other Skin	126.3	138.5	139.4	150.5	147.6	95.2	103.7	104.8	112.1	119.4
Breast	0.5	0.5	0.3	0.8	0.4	76.3	84.6	82.4	80.7	97.9
Cervix	–	–	–	–	–	6.6	8.2	7.1	7.0	6.9
Uterus	–	–	–	–	–	17.3	17.3	16.1	16.5	18.4
Ovary	–	–	–	–	–	16.6	12.9	12.0	12.8	13.0
Other Female Genital Organs	–	–	–	–	–	2.0	1.8	2.2	1.9	1.4
Prostate	57.5	63.7	65.7	76.2	79.8	–	–	–	–	–
Testis	4.3	3.9	4.3	4.0	4.0	–	–	–	–	–
Bladder	14.6	13.2	13.3	12.5	13.6	4.9	4.5	4.4	4.4	4.3
Kidney	9.5	7.8	7.8	8.0	10.6	4.0	5.1	5.0	5.5	4.5
Brain	8.9	6.1	5.6	6.3	7.1	4.0	4.9	4.0	4.6	4.5
Thyroid	1.6	1.1	1.7	1.9	1.8	3.6	3.5	4.2	4.2	4.6
Non-Hodgkin's Lymphoma	11.7	11.8	12.6	11.7	13.5	7.6	8.5	8.1	8.8	9.3
Hodgkin's Disease	3.2	3.4	2.3	2.4	2.7	2.9	1.5	2.3	1.9	1.8
Multiple Myeloma	4.0	3.3	3.5	3.2	4.4	3.1	2.8	2.4	2.0	3.5
Leukemia: Acute Lymphatic	1.8	2.3	1.9	2.2	1.9	1.3	1.0	1.2	0.9	1.3
Chronic Lymphatic	3.2	2.9	3.7	3.5	2.9	2.4	0.9	2.2	1.8	1.7
Acute Granulocytic	2.2	1.1	1.2	1.6	1.5	1.6	1.3	0.9	1.1	1.0
Chronic Granulocytic	1.5	0.8	1.5	1.3	1.4	0.8	0.9	0.8	0.7	1.4
Other & Unspecified	2.4	1.7	1.9	2.0	1.6	1.4	1.2	1.8	1.3	1.3
Other Primary Sites	6.2	6.1	5.5	5.9	6.8	3.7	3.0	4.0	4.1	4.1
Unknown & Ill-Defined Sites	10.8	8.7	9.4	9.6	8.9	9.9	9.3	8.8	10.1	10.2
TOTAL	428.3	440.7	441.7	462.4	468.4	369.9	384.9	378.6	389.8	418.2

Relative Frequency of New Cases of Cancer Diagnosed in 1988

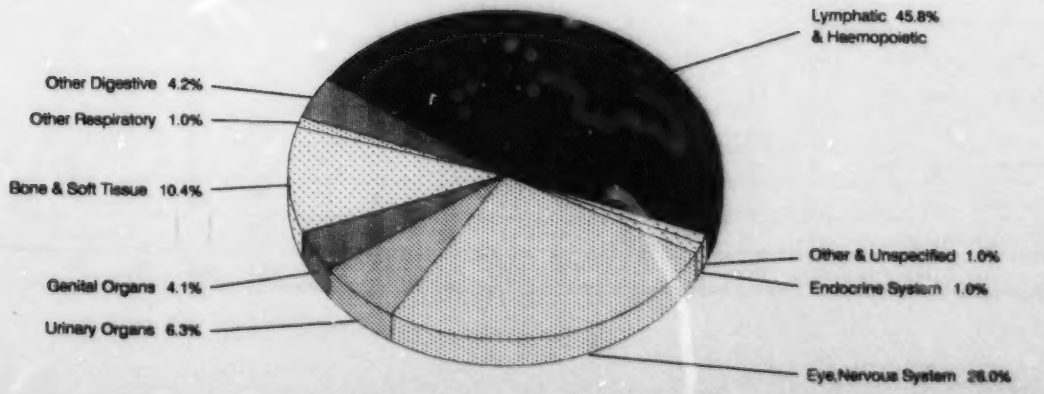
MALES 15 AND OVER



FEMALES 15 AND OVER



CHILDREN UNDER 15



B.C. Cancer Statistics 1988

Cancer Deaths by Sex and Age-Group

	0 - 34		35 - 44		45 - 54		55 - 64		65 - 74		75 - 84		85 - UP		TOTAL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip	0	0	0	0	0	0	0	0	1	0	1	0	0	1	2	1
Tongue	0	0	0	1	1	0	8	2	3	2	1	4	0	0	13	9
Mouth	0	0	1	0	1	0	5	2	6	5	4	1	1	4	18	12
Pharynx	0	0	3	2	7	1	15	2	3	1	6	0	0	0	34	6
Esophagus	0	0	2	0	7	2	21	6	31	14	26	17	2	6	89	45
Stomach	1	0	2	2	10	3	25	16	51	19	43	29	13	13	145	82
Small Intestine	0	0	1	0	0	1	0	0	1	0	3	4	1	1	6	6
Colon	0	2	8	3	9	9	39	37	74	62	59	54	15	40	204	207
Rectum	0	1	3	0	4	4	12	12	32	17	23	17	7	11	81	62
Liver	1	2	3	1	5	2	8	7	26	11	18	11	6	9	67	43
Gallbladder	0	0	1	1	1	3	7	6	9	8	8	11	3	6	29	35
Pancreas	1	1	1	5	5	4	31	27	54	52	50	52	14	23	156	164
Larynx	0	0	0	0	4	1	8	1	15	3	4	0	3	0	34	5
Trachea, Bronchus, Lung	1	0	10	13	56	55	240	100	345	226	264	130	56	31	972	555
Bone, Connective Tissue	4	0	0	2	2	2	3	1	7	5	4	3	2	3	22	16
Melanoma-Skin	3	1	5	3	8	6	6	5	13	6	3	4	1	4	39	29
Other Skin	0	0	1	0	0	1	2	0	2	2	0	0	0	3	5	6
Breast	1	6	0	37	1	57	2	122	1	152	4	104	0	37	9	515
Cervix	—	7	—	9	—	7	—	8	—	8	—	6	—	1	—	46
Uterus	—	0	—	1	—	4	—	11	—	23	—	13	—	5	—	57
Ovary	—	2	—	9	—	19	—	40	—	50	—	46	—	16	—	182
Other Female Genital Organs	—	0	—	0	—	0	—	4	—	3	—	3	—	2	—	12
Prostate	0	—	2	—	0	—	31	—	126	—	159	—	82	—	402	—
Testis	1	—	1	—	0	—	1	—	0	—	0	—	0	—	3	—
Bladder	0	0	0	0	1	0	17	4	30	13	39	15	24	11	111	43
Kidney	2	0	3	3	10	5	21	4	19	26	25	15	3	6	83	59
Brain	10	5	5	3	21	8	21	12	26	18	21	18	0	7	104	71
Thyroid	0	0	0	1	0	1	0	0	1	3	0	2	0	0	1	7
Non-Hodgkin's Lymphoma	8	2	10	5	13	5	13	16	40	25	31	25	5	10	120	88
Hodgkin's Disease	1	0	0	0	1	0	0	0	1	0	1	1	0	1	4	2
Multiple Myeloma	0	0	0	2	1	2	10	7	19	14	13	23	6	4	49	52
Leukemia: Acute Lymphatic	3	1	0	0	2	1	6	2	8	4	14	11	1	8	34	27
Chronic Lymphatic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acute Granulocytic	3	3	1	4	5	5	7	6	9	4	9	8	4	1	38	31
Chronic Granulocytic	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	2
Other & Unspecified	1	3	1	1	3	1	10	1	10	5	12	10	3	4	40	25
Other Primary Sites	3	1	3	1	8	3	23	23	32	25	27	34	10	16	106	103
Unknown & Ill-Defined Sites	1	0	1	3	4	7	25	29	62	56	40	48	22	34	155	177
TOTAL	45	37	68	112	190	219	617	513	1060	862	912	721	284	318	3176	2782

Mortality Rates (per 100,000) by Sex and Age-Group

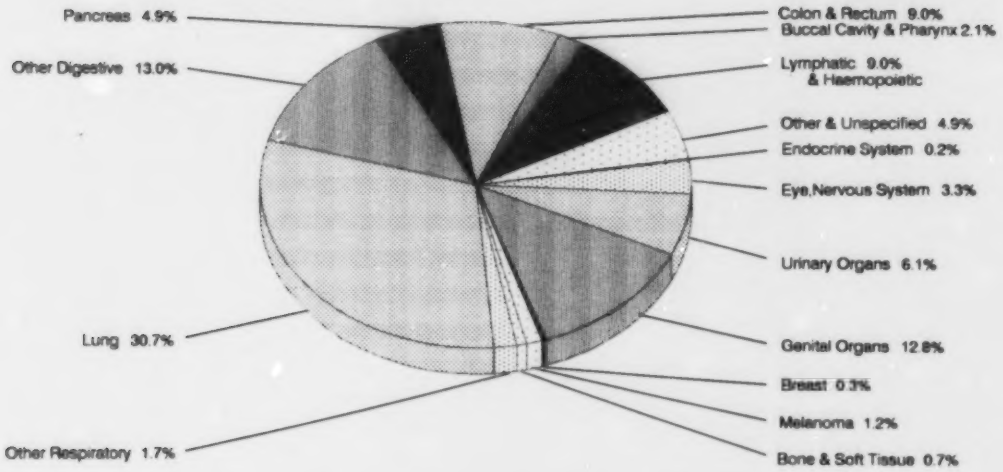
	0 - 34		35 - 44		45 - 54		55 - 64		65 - 74		75 - 84		85 - UP		TOTAL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	4.6	0.1	0.1
Tongue	0.0	0.0	0.0	0.4	0.6	0.0	5.7	1.4	2.9	1.6	2.0	5.9	0.0	0.0	0.9	0.6
Mouth	0.0	0.0	0.4	0.0	0.6	0.0	3.6	1.4	5.7	3.9	8.2	1.5	9.5	18.3	1.2	0.8
Pharynx	0.0	0.0	1.3	0.9	4.4	0.7	10.8	1.4	2.9	0.8	12.3	0.0	0.0	0.0	2.3	0.4
Esophagus	0.0	0.0	0.9	0.0	4.4	1.3	15.1	4.2	29.6	11.0	53.2	25.1	19.0	27.5	6.0	3.0
Stomach	0.1	0.0	0.9	0.9	6.3	2.0	17.9	11.3	48.8	14.9	87.9	42.8	123.8	59.6	9.8	5.4
Small Intestine	0.0	0.0	0.4	0.0	0.0	0.7	0.0	0.0	1.0	0.0	6.1	5.9	9.5	4.6	0.4	0.4
Colon	0.0	0.3	3.5	1.3	5.7	5.9	28.0	26.1	70.7	48.7	120.7	79.8	142.9	183.5	13.8	13.7
Rectum	0.0	0.1	1.3	0.0	2.5	2.6	8.6	8.5	30.6	13.4	47.0	25.1	66.7	50.5	5.5	4.1
Liver	0.1	0.3	1.3	0.4	3.2	1.3	5.7	4.9	24.9	8.6	36.8	16.2	57.1	41.3	4.5	2.9
Gallbladder	0.0	0.0	0.4	0.4	0.6	2.0	5.0	4.2	8.6	6.3	16.4	16.2	28.6	27.5	2.0	2.3
Pancreas	0.1	0.1	0.4	2.2	3.2	2.6	22.2	19.0	51.6	40.9	102.2	76.8	133.3	105.5	10.6	10.9
Larynx	0.0	0.0	0.0	0.0	2.5	0.7	5.7	0.7	14.3	2.4	8.2	0.0	28.6	0.0	2.3	0.3
Trachea, Bronchus, Lung	0.1	0.0	4.3	5.7	35.3	35.8	172.0	70.5	329.8	177.7	539.9	192.0	533.3	142.2	65.8	36.8
Bone, Connective Tissue	0.5	0.0	0.0	0.9	1.3	1.3	2.2	0.7	6.7	3.9	8.2	4.4	19.0	13.8	1.5	1.1
Melanoma-Skin	0.4	0.1	2.2	1.3	5.0	3.9	4.3	3.5	12.4	4.7	6.1	5.9	9.5	18.3	2.6	1.9
Other Skin	0.0	0.0	0.4	0.0	0.0	0.7	1.4	0.0	1.9	1.6	0.0	0.0	0.0	13.8	0.3	0.4
Breast	0.1	0.8	0.0	16.1	0.6	37.1	1.4	86.0	1.0	119.5	8.2	153.6	0.0	169.7	0.6	34.2
Cervix	—	0.9	—	3.9	—	4.6	—	5.6	—	6.3	—	8.9	—	4.6	—	3.1
Uterus	—	0.0	—	0.4	—	2.6	—	7.8	—	18.1	—	19.2	—	22.9	—	3.8
Ovary	—	0.3	—	3.9	—	12.4	—	28.2	—	39.3	—	67.9	—	73.4	—	12.1
Other Female Genital Organs	—	0.0	—	0.0	—	0.0	—	2.8	—	2.4	—	4.4	—	9.2	—	0.8
Prostate	0.0	—	0.9	—	0.0	—	22.2	—	122.4	—	325.2	—	781.0	—	27.2	—
Testis	0.1	—	0.4	—	0.0	—	0.7	—	0.0	—	0.0	—	0.0	—	0.2	—
Bladder	0.0	0.0	0.0	0.0	0.6	0.0	12.2	2.8	28.7	10.2	79.8	22.2	228.6	50.5	7.5	2.9
Kidney	0.3	0.0	1.3	1.3	6.3	3.3	15.1	2.8	18.2	20.4	51.1	22.2	28.6	27.5	5.6	3.9
Brain	1.3	0.7	2.2	1.3	13.2	5.2	15.1	8.5	24.9	14.2	42.9	26.6	0.0	32.1	7.0	4.7
Thyroid	0.0	0.0	0.0	0.4	0.0	0.7	0.0	0.0	1.0	2.4	0.0	3.0	0.0	0.0	0.1	0.5
Non-Hodgkin's Lymphoma	1.0	0.3	4.3	2.2	8.2	3.3	9.3	11.3	38.2	19.7	63.4	36.9	47.6	45.9	8.1	5.8
Hodgkin's Disease	0.1	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.0	0.0	2.0	1.5	0.0	4.6	0.3	0.1
Multiple Myeloma	0.0	0.0	0.0	0.9	0.6	1.3	7.2	4.9	18.2	11.0	26.6	34.0	57.1	18.3	3.3	3.4
Leukemia: Acute Lymphatic	0.4	0.1	0.0	0.0	1.3	0.7	4.3	1.4	7.6	3.1	28.6	16.2	9.5	36.7	2.3	1.8
Chronic Lymphatic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acute Granulocytic	0.4	0.4	0.4	1.7	3.2	3.3	5.0	4.2	8.6	3.1	18.4	11.8	38.1	4.6	2.6	2.1
Chronic Granulocytic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	3.0	0.0	0.0	0.1	0.1
Other & Unspecified	0.1	0.4	0.4	0.4	1.9	0.7	7.2	0.7	9.6	3.9	24.5	14.8	28.6	18.3	2.7	1.7
Other Primary Sites	0.4	0.1	1.3	0.4	5.0	2.0	16.5	16.2	30.6	19.7	55.2	50.2	95.2	73.4	7.2	6.8
Unknown & Ill-Defined Sites	0.1	0.0	0.4	1.3	2.5	4.6	17.9	20.4	59.3	44.0	81.8	70.9	209.5	156.0	10.5	11.7
TOTAL	5.8	4.8	29.3	48.8	119.9	142.6	442.3	361.5	1013.4	677.7	1865.0	1065.0	2704.8	1458.7	215.2	184.5

Age Standardized Mortality (per 100,000) by Sex

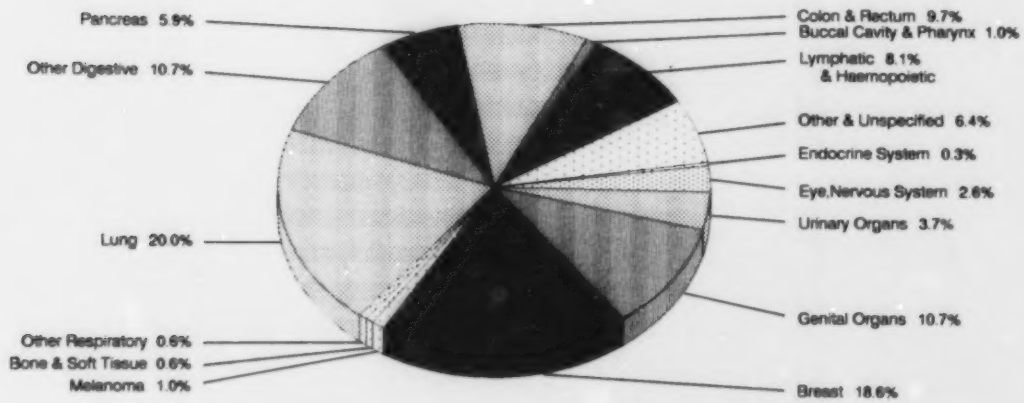
	Male					Female				
	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
Lip	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Tongue	1.2	0.6	1.4	0.7	0.7	0.5	0.4	0.5	0.5	0.4
Mouth	0.8	0.9	0.8	0.5	0.9	0.4	0.3	0.7	0.4	0.5
Pharynx	2.1	1.8	1.4	1.7	1.8	0.7	0.4	0.8	0.6	0.3
Esophagus	4.7	4.6	4.1	4.9	4.3	2.0	1.4	1.9	1.0	2.0
Stomach	7.7	7.1	8.3	7.0	6.9	3.7	4.8	4.0	4.4	3.7
Small Intestine	0.4	0.2	0.2	0.4	0.3	0.2	0.4	0.3	0.2	0.3
Colon	13.6	11.2	11.2	12.6	9.7	11.2	11.2	10.8	11.0	9.2
Rectum	4.3	4.3	4.1	3.8	3.8	3.5	2.9	2.6	3.5	2.8
Liver	2.5	3.1	3.2	3.3	3.2	1.1	1.2	2.2	1.6	2.0
Gallbladder	1.4	1.3	1.5	0.7	1.4	2.2	2.0	1.6	2.3	1.6
Pancreas	7.7	8.2	9.0	7.6	7.4	7.6	6.1	6.4	7.2	7.3
Larynx	1.9	1.5	2.0	1.7	1.7	0.1	0.3	0.3	0.5	0.2
Trachea, Bronchus, Lung	51.6	48.6	47.1	46.7	46.9	20.6	21.9	25.0	25.8	26.0
Bone, Connective Tissue	1.5	1.3	1.3	0.8	1.2	1.2	1.0	1.1	0.9	0.7
Melanoma-Skin	1.5	2.2	2.0	1.5	2.0	1.9	1.3	1.1	1.9	1.5
Other Skin	0.8	0.2	0.3	0.7	0.2	0.2	0.3	0.0	0.4	0.3
Breast	0.1	0.2	0.1	0.2	0.5	23.4	24.8	25.4	23.5	25.1
Cervix	—	—	—	—	—	2.2	2.5	2.0	1.8	2.4
Uterus	—	—	—	—	—	2.9	2.2	2.6	3.0	2.6
Ovary	—	—	—	—	—	8.7	7.3	7.9	7.8	8.7
Other Female Genital Organs	—	—	—	—	—	0.6	0.4	0.6	0.4	0.5
Prostate	16.7	16.3	19.0	18.4	18.2	—	—	—	—	—
Testis	0.3	0.4	0.1	0.3	0.2	—	—	—	—	—
Bladder	4.3	5.0	4.3	3.7	5.2	1.6	1.7	1.5	1.3	1.8
Kidney	4.3	3.8	3.7	3.5	4.3	2.1	1.6	2.0	2.0	2.7
Brain	5.6	5.7	4.6	5.4	5.5	2.9	3.5	2.6	3.1	3.5
Thyroid	0.5	0.1	0.2	0.2	0.0	0.6	0.4	0.1	0.1	0.3
Non-Hodgkin's Lymphoma	4.7	5.9	4.7	5.1	6.0	4.0	4.4	3.7	3.6	4.1
Hodgkin's Disease	0.4	0.2	0.7	0.5	0.2	0.2	0.6	0.4	0.2	0.1
Multiple Myeloma	2.4	2.5	2.6	2.6	2.3	2.4	2.3	2.1	1.6	2.3
Leukemia: Acute Lymphatic	0.7	0.5	0.6	0.7	1.7	0.8	0.7	0.3	0.5	1.2
Chronic Lymphatic	1.5	1.3	1.1	1.6	0.0	0.9	0.9	0.5	0.6	0.0
Acute Granulocytic	1.3	1.3	0.8	1.1	2.0	1.5	0.9	1.1	0.5	1.7
Chronic Granulocytic	1.1	0.8	0.6	0.5	0.0	0.7	0.5	0.6	0.4	0.1
Other & Unspecified	3.3	2.1	1.7	1.5	2.0	1.6	1.6	1.5	1.6	1.2
Other Primary Sites	4.7	5.5	4.5	5.3	5.2	5.2	5.4	4.7	3.6	4.7
Unknown & Ill-Defined Sites	5.9	5.9	8.6	7.2	7.3	6.9	6.3	6.8	7.0	7.9
TOTAL	161.1	154.6	156.1	152.4	153.3	126.6	124.1	125.8	124.9	129.6

Relative Frequency of Cancer Deaths in 1988

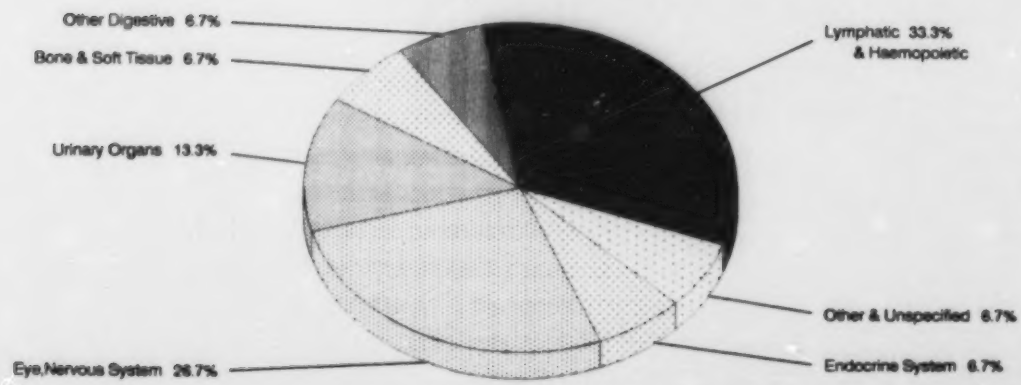
MALES 15 AND OVER

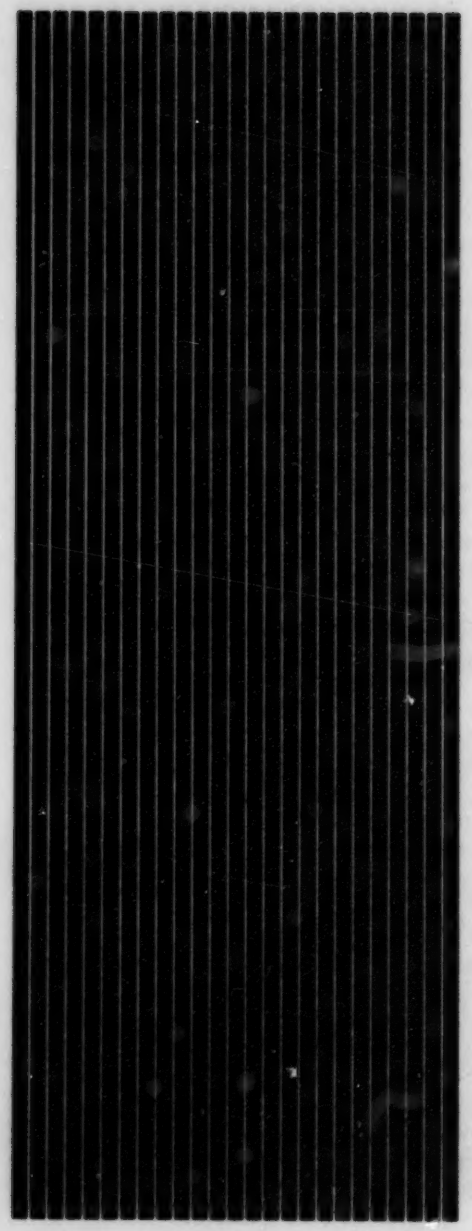


FEMALES 15 AND OVER



CHILDREN UNDER 15





British
Columbia
Cancer
Research
Centre

About The B.C. Cancer Research Centre

Cancer research is playing an increasingly important role in the diagnosis and treatment of the disease. Scientists at the British Columbia Cancer Research Centre work in close collaboration with the B.C. Cancer Agency, studying new drugs and treatment protocols, seeking improvements in radiation, chemotherapy and hormonal therapy. Other scientists study the incidence of cancer in society and in the workplace to define, if possible, particular patterns in the distribution of various types of cancer amongst the general population. Still others, working in the realm of basic research, in an attempt to unravel the mystery of how and why the disease gets started in the first place, are exploring the field of molecular genetics. Many of these research protocols are winning international acclaim for our scientists and have placed the Research Centre in the forefront of cancer research in the world.

Scientific responsibilities at the Research Centre are divided amongst seven units/divisions:

Medical Biophysics Unit

Low dose radiation studies; biological effects of ionizing radiation; improvements in radiotherapy; new combinations of radiation and chemotherapy.

Epidemiology, Biometry and Occupational Oncology

Geographic mapping of cancer in B.C.; the epidemiology of breast cancer in B.C.; risk factors for melanoma; studies of cancer in the workplace.

Advanced Therapeutics

New methods of diagnosis and advances in the administration of chemotherapy; studies in the application of such immune defence modifiers as Interferon and Interleukin II.

Cancer Endocrinology

The application of hormonal therapy to various cancer sites, with particular emphasis on cancer of the prostate and breast cancer.

Terry Fox Laboratory

Studies of cancers of the blood such as leukemia and lymphomas; research into bone marrow transplantation including autologous bone marrow transplants; studies in gene transfer technology.

Environmental Carcinogenesis

The role of the environment, lifestyles and genetics in the development of cancer. Studies into the administration of simple drugs which may inhibit the disease in major population segments.

Medical Biophysics Unit

SENIOR STAFF

Dr. L.D. Skarsgard
Head, Radiation Biophysics
Physics/Pathology, UBC

Dr. D.J. Chaplin
Radiation Biology Pathology, UBC

Dr. R.E. Durand
Radiation Biology
Pathology/Physics, UBC

Dr. P.L. Olive
Radiation Biology,
Pathology, UBC

Dr. K.A. Skov
Biochemistry, Pathology, UBC

ASSOCIATE MEMBERS

Dr. B.D. Acker
Division of Radiation Oncology, CCABC Surgery, UBC

Dr. G.B. Goodman
Head, Section of Developmental Radiotherapy CCABC, Surgery, UBC

Dr. R.O. Kornelsen
Head, Physics Division CCABC, Physics, UBC

Dr. G.K.Y. Lam
Physics, Division, CCABC
Physics/Pathology, UBC

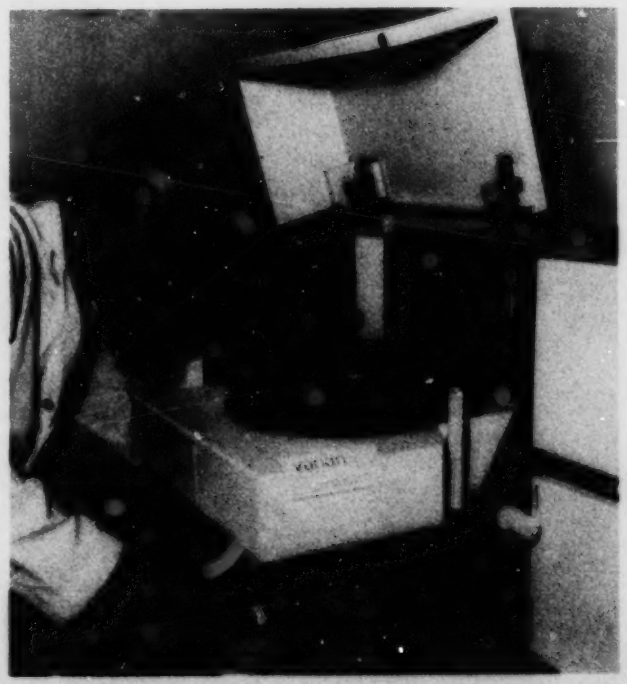
Dr. B. Palcic
Physics Division, Cancer Imaging, CCABC
Physics/Pathology, UBC

POSTDOCTORAL FELLOWS

Dr. J. Benath
Dr. A.I. Minchinton
Dr. M.J. Trotter
Dr. D. Wlodek
Dr. R. Yan

GRADUATE STUDENTS

R. Brown
J. Matthews
G. Meng
M. Skwarchuk
D. Yapp



The Atomic Absorption Spectrometer in the Medical Biophysics Unit, operated here by Hans Adomat, will facilitate the trace analysis of numerous elements. Uptake and binding of the most promising of the recently patented series of cisplatin analogues are the first studies being undertaken.

OVERVIEW

The primary objective of the current research programs in the Medical Biophysics Unit is to improve the radiation treatment and, to a certain extent, the chemotherapy treatment of cancer. Much of our work is aimed at exploiting the biological and physiological properties that are peculiar to many solid tumours. For example, rapidly growing tumours often outgrow their blood supply, with the result that parts of the tumour become hypoxic (oxygen deficient). This is a very serious problem for radiation therapy because hypoxic tumour cells are three times as resistant to radiation as aerobic tumour cells. One solution to this problem is to use *radiosensitizers*, drugs which can sensitize these hypoxic cells to radiation, and several such drugs are being tested clinically at the present time. It was first demonstrated in our laboratories that some such drugs are also selectively *toxic* to hypoxic cells without radiation (in the absence of oxygen the drugs are reduced to a much more toxic form) and this has led to a great deal of interest in the possible chemotherapeutic value of such drugs, called hypoxic cytotoxins. Dr. Chaplin has shown that these cytotoxic effects can be substantially enhanced through rather simple manipulation of tumour blood flow, and new clinical protocols are being tested at the B.C. Cancer Agency to see if this approach is useful in treatment of certain human tumours.

Dr. Skov and her colleagues have developed a whole new class of drugs, some of which are able to act as radiosensitizers as well as hypoxic cell cytotoxins. These are being tested in both mammalian cells and in tumour models.

Drs. Trotter, Olive and Chaplin have clearly demonstrated that blood flow in mouse tumours has an intermittent component, with some of the blood vessels being closed for periods of 5 minutes or more. This creates very serious problems for both radiotherapy and chemotherapy and methods to overcome this situation are being investigated.

In Dr. Durand's laboratory, he and his associates are using multicell spheroids as a tumour model system to study ways of optimizing tumour treatment when combinations of drugs or radiation plus drugs are being used. They are also using human tumour xenografts grown in nude mice (immune-deficient mice which thus do not reject the human cells) as a second stage model system to test new approaches to tumour treatment.

Dr. Skarsgard and his colleagues are developing a 'library' of human tumour cell lines that will be used in conjunction with their low dose radiation inactivation assay. This cell sorter assay provides more accurate measurement of tumour cell killing in the clinical dose range. The human tumour cell lines will be tested as a model system for the investigation of new treatment strategies.

Further details on these and some of the other programs in our unit are described in the following sections.

The pion therapy program at TRIUMF is progressing well. A new randomized trial for cancer of the prostate was begun recently, on the basis of encouraging results from a pilot study of approximately 40 patients already treated at TRIUMF. The randomized trial for glioblastoma brain tumour patients is also continuing. The pion treatment facility was developed by the Medical Biophysics Unit and is now operated by the B.C. Cancer Agency under the direction of Dr. G.B. Goodman (more details of that program will be found in the report of the Section of Developmental Radiotherapy).

This year again, our professional staff gave a lecture course in Radiobiology to the residents training in Radiation Oncology at the B.C. Cancer Agency. The course consisted of fifteen 2 hour lectures, with lots of open discussion. We continue to teach a course in Radiation Biophysics at UBC and we also give a number of lectures as a regular part of other courses. At present, there are 10 graduate students and post-doctoral fellows doing their research under the supervision of Medical Biophysics professional staff.

Our staff continue to serve on a number of national and international scientific organizations. These include grant review panels (MRC, NCI, NIH (US)), editorial boards (Radiation Research, Cancer Research), councils of scientific societies and a number of committees, advisory groups, etc. We are also frequently asked to serve on review teams to evaluate research programs at other institutions.

Presentation of our work at scientific meetings is, of course, an important part of our research effort and in the past year our professional staff, post-doctoral fellows, graduate students and some research assistants have presented papers at a number of national and international meetings, often as invited speakers. We have also been visited this year by a number of distinguished scientists and oncologists from around the world.

Dr. Martin Trotter has again done an excellent job of coordinating our weekly Medical Biophysics Unit seminars, which bring together all technical and professional staff, post-doctoral fellows, graduate students, etc.

The following section briefly reviews some of the research projects in progress at this time, and a list of our papers published in 1989-90 appears following the research reports of the various departments.

DNA Targeted Drugs for Hypoxic Radioresistant Cells

Kirsten A. Skov

Dr. Skov's group is continuing to develop drugs aimed at improving radiotherapeutic treatment, either by radiosensitization or by selective killing of the hypoxic resistant cells. Analogues of known radiosensitizers or cytotoxins are being designed to bind to DNA, with the intent of making the sensitization more effective in the clinically used radiation dose range (in the case of radiosensitizers) or conferring hypoxic selectivity to chemotherapeutic agents (hypoxic cytotoxins). These studies will be greatly facilitated by two

very recent acquisitions: (1) an atomic absorption spectrophotometer will be used to measure the uptake of metal containing drugs in cells and in tumours as well as their DNA binding, and (2) a molecular modelling program "GEMINI" will be used to study DNA drug interactions to facilitate design of new compounds. The former was purchased through funds from the National Cancer Institute of Canada, B.C. Health Care Research Foundation, and the Health Development Fund; we are grateful to the Order of the Eastern Star for funding GEMINI, and to the Jambor Foundation for facilitating training in this area.

Through operating grants from MRC and NCI of Canada, new compounds are being synthesized and assessed, including platinum nitroheterocycle complexes (with N.P. Farrell, University of Vermont), groove-binding nitro-oligopeptides (H. Adomat and G.S. Bates), ruthenium-nitroimidazoles and porphyrins (D.T.T. Yapp, G. Meng and B.R. James, U.B.C.) which are compared with existing drugs in mammalian cells (S. MacPhail and P. Walter), and in tumour models (J.B. Matthews and D.J. Chaplin).

Intermittent Blood Flow in Tumours
Martin Trotter and Peggy Olive

We have previously shown using a fluorescent staining technique that within the blood vessels of some mouse tumours blood does not flow constantly; instead the flow occurs in a stop-and-go fashion. About 10% of tumour vessels experience periods of no-flow lasting at least 5 minutes. Patches of tumour tissue are influenced by this phenomenon and these areas are found most often in the central regions of large tumours. Quantitative assessment, using an image processing system, of fluorescent stain delivery to individual tumour vessels reveals that a further 15% of vessels experience shorter periods of no-flow or simply episodes of reduced flow. Such fluctuations in tumour blood flow can potentially influence the response of a tumour to radiation therapy and some types of chemotherapy. For radiation therapy to be effective, delivery of adequate oxygen to tumour cells is very important; lack of oxygen allows tumour cells to survive a dose of radiation. Temporary stoppages of blood flow in some tumour blood vessels can result in no oxygen delivery to nearby tumour cells and thus these cells become transiently resistant to treatment.

Recent work has shown that episodes of no-flow in tumour vessels can be reduced if blood pressure is raised using drugs. Infusion of the drug angiotensin II prevents closure of tumour blood vessels, increases oxygen delivery, and improves the response of mouse tumours to radiation. Other agents such as nicotinamide, the precursor of the vitamin niacin, also significantly improve blood flow in tumour blood vessels. If fluctuations in blood flow occur within human tumours then the use of drugs to eliminate these flow stoppages may result in an improved response to radiation therapy and perhaps a more uniform delivery of chemotherapy drugs to tumour cells.

DNA Damage Measurements
P.L. Olive, J.P. Banath and D. Wlodek

Killing tumour cells using drugs and radiation usually requires damaging DNA, the genetic material of the cell. If the DNA damage cannot be repaired, the cell will be unable to reproduce and will eventually die. A number of methods are being developed and applied to the measurement of DNA damage in tissue culture cells, mouse tumour cells and human tumour cells. Most of these methods measure the average response of thousands of tumour cells, but the "comet assay" lets us measure DNA damage within a single cell. This is an important advantage since it gives us a way to identify tumour cells which have responded to treatment and those which are resistant. Using the comet assay, we are also able to identify those tumour cells that are actively growing and those which are "resting".

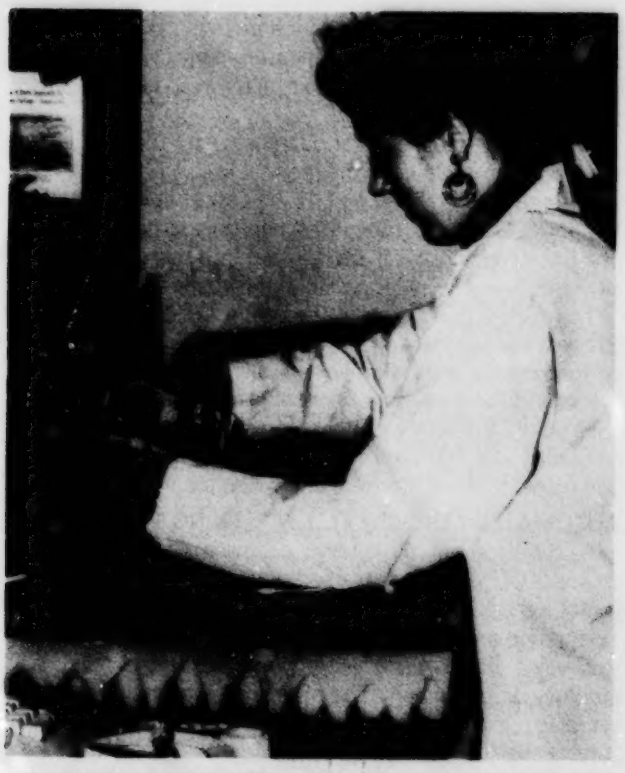
Perhaps the most important type of DNA damage produced by ionizing radiation is the DNA double-strand break. Double-strand breaks are difficult for a tumour cell to repair, and they can cause breaks in chromosomes and cell death. The neutral filter elution method is used by many laboratories world-wide to measure double-strand breaks, but exactly how this method works has been the subject of controversy for several years. During the last year, we have examined the physical basis for this method. Our results (using the new method of pulsed-field gel electrophoresis) suggest that neutral filter elution detects not only DNA double-strand breaks, but also changes in DNA "packaging" which are important in the repair of DNA damage.

Chemotherapy and Radiotherapy as Combined Modalities in Human Tumour Xenografts
Ralph E. Durand and Rendi Yan

Local failure remains a major problem in solid tumour radiotherapy, and at least a part of tumour radioresistance is generally agreed to be linked to the deficient oxygen supply in the tumour. Considerable effort thus continues to be directed towards development of new and better hypoxic cell radiosensitizers, as well as to development of agents to specifically kill the troublesome hypoxic cells. Our ongoing studies with an in vitro tumour model system, spheroids, have suggested a more immediate approach to accomplishing the same objective: several chemotherapeutic drugs in common clinical use may increase tumour radiosensitivity (via indirect processes), or may preferentially kill cells in hypoxic areas of tumours. We are now evaluating several drugs to see whether they can indeed produce these effects in human tumour xenografts grown in nude mice.

Ultimately, tumour cell oxygenation is dependent upon two factors: delivery of oxygen to the tumour (blood flow), and

removal of oxygen by normal metabolic processes (cellular respiration). Manipulation of either of these factors will modify tumour oxygenation, and thus net radiosensitivity. The key question is, of course, whether therapeutically useful modification of tumour cell oxygenation can be achieved in human tumours without toxicity to the patient. Our results to date, using cisplatin in conjunction with radiotherapy, have shown a number of intriguing and promising results. Cisplatin, at doses which can be administered in the clinic, appears to increase tumour blood flow, to inhibit tumour oxygen consumption, to preferentially radiosensitize the hypoxic cells when they exist, and to inhibit repair of radiation damage in the tumour. All of these are significant observations, suggesting that administration of the drug just before beginning radiotherapy should increase tumour responsiveness. Additionally, we have recently found that drug treatment in conjunction with other physiological maneuvers to further increase blood flow and tumour oxygenation (e.g., breathing carbogen) offers even more potential for improving the tumour response. We are thus expanding our studies with cisplatin, as well as evaluating other common chemotherapeutic agents.



Carrie Peters is styding the effects of the vasoactive anti-cancer drug, flavone acetic acid (FAA) on tumour blood flow, using the Doppler Laser Blood Flow apparatus. A graduate of UBC (Physiology), Carrie has worked as a Research Assistant in Dr. Chaplin's lab for the past year. In September she will begin study toward her Ph.D. at the Gray Laboratory in London, England. We wish her well.

Human Tumour Cell Lines as a Model System
L.D. Skarsgard

Radiation treatment of cancer is commonly given as a series of small daily doses over several weeks until damage to the tumour accumulates to the point where it is destroyed. This approach has the advantage that it spares normal tissues in close proximity with the tumour and which inevitably receive some radiation exposure during treatment. If one wishes to carry out laboratory studies of some new treatment strategy, it is important to use doses comparable to the small daily doses used in patients, if the results are to be relevant to the clinic. The problem has been that at these doses, approximately 2 Gy, it is very difficult to measure accurately the relatively small amounts of tumour cell kill which occur with each dose. Attempts to predict effects at low dose by extrapolating from measurements made at much higher doses are fraught with uncertainty. At the same time, however, there is growing evidence that the *clinical* response of human tumours to radiation is closely related to the *laboratory* response, measured in cells cultured from the respective tumour, *provided* that the laboratory measurements are made at low dose. Using a technique developed and refined in the Medical Biophysics Unit we have been able to obtain a significant improvement in accuracy of cell inactivation measurements at low dose. The technique uses a cell sorter to 'dispense' accurately known numbers of cells for plating. Using this technique we were able to show that there is detailed structure, not previously seen, in the dose response curve for rapidly dividing cells and we have shown that the structure is due to the presence of subpopulations of cells of different radiosensitivity. We have recently begun a new program in which we are using this technique in conjunction with a library of 6 or 8 human tumour cell lines, representing a variety of difficult-to-treat tumours. This will be used as a model system to model the response of different human tumours to particular, new radiation treatment strategies. We will first use the system to test the efficacy of four different types of radiosensitizers. The personnel involved in this work includes Mark Skwarchuk, Adriana Vinczan and Lloyd Skarsgard, with Denise McDougal and Nancy LePard providing the cell sorting service under Dr. Durand's supervision.

ACKNOWLEDGEMENTS

The Medical Biophysics Unit received research operating grants from a number of sources during 1989-90: the National Cancer Institute of Canada, the Medical Research Council, the B.C. Health Care Research Foundation, the National Institutes of Health (U.S.). Additional special funds were also obtained from the Order of the Eastern Star, the Jambor Knowledge Fund and from the pharmaceutical firm of Ciba-Geigy. Our core budget is provided by the B.C. Cancer Foundation.

Cancer Imaging

SENIOR STAFF

Branko Palcic, Ph.D.
Head, Senior Scientist
Biophysicist
Associate Professor, Pathology & Physics, UBC
Adj. Professor, Faculty of Applied Science, SFU

Bruno Jaggi, M.A.Sc., P.Eng.
Head, Engineering
Research Engineer

Mladen Korbelik, Ph.D.
Scientist, Cell Biology
Scholar of the B.C. Health Care Research Foundation

Calum MacAulay, Ph.D.
Scientist, Physics

The main objective of the Cancer Imaging Section, Physics Division, is to find means for the detection of early cancers. In recent years several new sensors have become available which, coupled with the development of fast processors, allow us to research and develop new investigative apparatuses which extend early detection performance beyond human capabilities. A selection of these major projects is described in the following report.

SOLID STATE MICROSCOPE

Historically, the microscope was used for the investigation of cells and tissues in great detail. Changes in nuclear size, shape and distribution of nuclear material of appropriately stained cells were used for diagnostic and prognostic procedures. However, for objective cell and tissue classifications quantitative microscopy must be employed. Quantitative microscopes capture images, transforming them into a set of numbers which can then be manipulated in computers. Exact measurements of diseased cell features such as cell size, shape, amount of DNA, etc. can be performed and compared to those of normal cells.

Present day quantitative microscopes are composed of a conventional microscope equipped with a video camera and computer linked to an imaging board. However, microscopes and video technology evolved for human vision and are not suited for precise quantitative measurements. Captured images from existing systems lack detail in spatial and photometric information.

Realizing the true needs for quantitative microscopy, particularly as it relates to the medical field, a unique device was designed and developed by the Cancer Imaging staff. The Solid State Microscope (SSM) improves spatial resolution (the fine detail which can be resolved by a microscope), increases field of view severalfold (the image's size as seen by the device), and increases the contrast (the number of different shades that can still be resolved). In addition, the performance of the system is equivalent for all microscopy modes including measurements of faint fluorescence. The Solid State Microscope has been successfully tested in the laboratory and is already in great demand by researchers and pathologists at the B.C. Cancer Agency and elsewhere.

AUTOMATED CERVICAL CELL SCREENING SYSTEM

The development of the cervical sample pre-screening device (ACCESS) has progressed significantly. A laboratory prototype has been completed which still uses conventional microscope and video technology. Nevertheless, it allows us to develop algorithms for automated detection of cells, autofocussing, segmentation of cell nuclei from the cytoplasm and background, feature extraction, cell and sample classification. Using historical samples from the B.C. Cancer Agency, cell classification performance by this laboratory prototype of ACCESS approached human expert performance. Sample classification data indicated that pre-screening accuracy can also be achieved with false negative rates (the number of samples with pre-cancerous or

cancerous cells which are wrongly classified as normal samples) equal to that of well-trained cytotechnicians.

ACCESS is envisioned to be used to divide cervical samples into two categories, eliminating the need for the majority of normal samples to be examined in great detail by skilled cytotechnicians and cytopathologists. It is hoped that the workload of these experts can be significantly reduced to enable them to concentrate on samples which potentially include pre-cancerous and cancerous cells.

The clinical prototype, based on solid state microscope technology, is scheduled for early 1991. Several of these devices will then be tested in Canada and the U.S. for potential practical application.

LUNG IMAGING FLUORESCENCE ENDOSCOPE

Detection and localization of early lung cancer, e.g. carcinoma in situ stage, may save lung cancer patients' lives. However, using the present means of x-ray and bronchoscopy detection, lung cancer is generally detected at such a late stage that fewer than 15% of patients can be successfully treated.

Scientists and engineers from Cancer Imaging have researched and developed a new device for lung investigation called LIFE. It exploits tissue autofluorescence properties to make otherwise occult lung lesions visible. This can be achieved without the use of tumor localizing drugs such as haematoporphyrins. Our clinical prototype facilitates detection and delineation not only of carcinoma in situ lesions but also severe dysplastic (pre-cancerous) lesions.

A practical clinical device is being built and tested in the operating room of B.C. Cancer Agency. By early 1991, several such devices will be available for routine clinical use in Canada and elsewhere. These can be simply added to the existing bronchoscopes without affecting present day clinical procedures. Thus, early acceptance of the new technology in routine clinical practice is anticipated.

OTHER PROJECTS

Several new projects are underway involving several graduate students. For example, basic research in detection of breast and skin cancer has been initiated. A recent donation of Mr. and Mrs. Lougheed greatly accelerated this research allowing us to develop an image acquisition system for digitization of x-ray mammograms at the desired spatial and photometric resolutions.

An important aspect of Cancer Imaging research is the assessment of the malignant potential of small, early cancers. Using sophisticated measuring tools developed by this research unit, cellular and tissue features are measured and compiled for statistical analysis to establish the correlation between successful and unsuccessful treatments. Most of the work is presently concentrated on cervical and breast cancers, but in the near future prostate, skin and other sites will be included.

Figure 1: Lung Imaging Fluorescence Endoscope (LIFE) prototype has been tested in the BCCA. After patient examination, the operating room team is standing from left to right: John Fengler (engineer), Dr. Massud Radjinia (engineer), Dr. Stephen Lam (respirologist), Jaclyn Hung (graduate student, physics), Francine Catonio-Begley (respiratory technologist) and Jackie Rypstra (nurse).

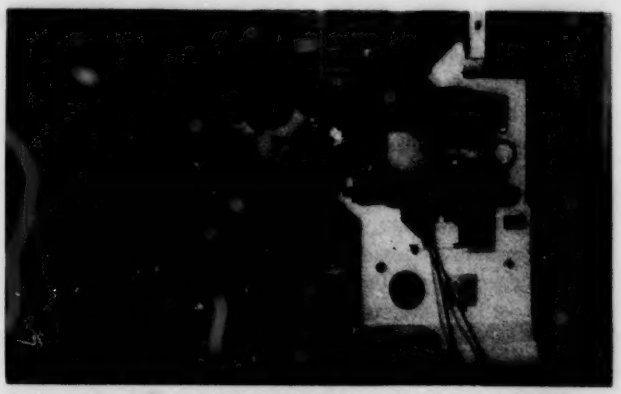


Figure 2: The Automated Cervical Cell Screening System (ACCESS) laboratory prototype is being tested by Dr. David Gardner (chemistry) using conventionally deposited cervical cells on a microscope slide.

Figure 3: Cells and tissues are often examined live using vital fluorescent stains to study drug delivery, effects of physical and chemical agents, etc. Working on these projects are from left to right: Gorazd Krosl (graduate student, pathology), Dr. Ingrid Spadinger (biophysics), Dr. Mladen Korbelik (cell biology), and Babak Raissi (summer student, chemistry).

Developmental Radiotherapy

SENIOR STAFF

G.B.Goodman, MB, ChB, DMRT, FRCPC, FRCP(Edin), FRCR, FACR, Clinical Professor
Head, (Surgery)

T.A.Pickles, BSc, MRCP, FRCR, Clinical Fellow) TRIUMF

Y.Takai, MD, PhD, Fellow – TRIUMF

1. PARTICLE RADIOTHERAPY AT TRIUMF (in cooperation with Dr.E.Vogt, Director of TRIUMF, UBC and Dr.Lloyd Skarsgard, Head, Medical Biophysics BCCF)

PION RADIOTHERAPY AT TRIUMF

A total of 227 patients have now been treated with pimesons at TRIUMF. As reported in the last year, a prospective randomized trial for glioblastoma multiforme was begun in 1988 and a total of 28 patients has been accrued into the study, 15 patients to the pion arm and 13 to the photon arm. 82 patients are required for completion of the study. Accruals have been slower than were originally estimated, due to the specific requirements of the study.

A prospective, comparative study of pions vs photons for patients with clinical stage C or D (clinical stage T3 or T4, N0 or Nx, M0) adenocarcinoma of the prostate began in June 1990. This study compares normal tissue tolerance doses of pions estimated at 37.5 Gy in 15 fractions to the best standard photon therapy estimated at 66 Gy in 33 fractions. Patients are stratified by stage, tumour grade and prostatic specific antigen level. Principal end points of the study are an improvement in survival of 15% and in local control of 20% at 5 years. It is estimated that patient accrual would be complete in 2.5 years with study analysis done after a further 4.5 years of follow-up. The study, which began in June of this year, has randomized 23 patients, 16 to the photon arm of the study and 7 to the pion arm of the study.

Dr.Y.Takai from Tohoku University School of Medicine has undertaken work studying the RBE of pions for a murine transplantable tumour system (the B-16 melanoma transplanted into C59BL mice) using 250 kV x-rays as a reference. Different RBE values were obtained at different response levels and these were 1.41, 1.53 & 1.66 for 20 days, 12.5 days & 5 days of growth delay time respectively. He also has combined therapy with pions and SPG for B16 melanoma. A 2-dose level study (600 Cgy and 200 cGy as a daily dose) of 4 fractions were used for the experiments. SPG was injected intramascularly every day from 1 day after the 4th fraction. Significant differences were found in the group of 600 cGy in terms of local tumour growth and incidence of lung metastases, while no difference was found in the 200 cGy group.

PROTON BEAM THERAPY

A proposal is now being prepared for a proton beam facility at TRIUMF for neuroradiosurgery for malignant tumours of the eye.

HYPOXIC CHEMOSENSITIZATION AND TUMOUR BLOOD FLOW (Dr.B.Acker, Dr.D.Rheaume, Dr.C.M.Ludgate, Dr.D.Chaplin)

Tumour blood flow can be depleted using the vasodilator drug Hydralazine. Dr.Acker had previously tested this clinically in patients undergoing radiotherapy for carcinoma of the cervix to determine clinical tolerance to the drug. Dr.Rheaume has designed a trial to undertake Hydralazine Toxicity Studies for recurrent biopsy proven glioblastoma.

STAFF APPOINTMENTS ETC

Dr.Thomas A.Pickles joined us in April 1990 as TRIUMF Fellow, replacing Dr.Julie Bowen who is currently functioning as a locum radiation oncologist in Victoria. Dr.Pickles qualified in the Middlesex Hospital in London, England and trained in radiation oncology at Bristol in St.Bartholomew's Hospital. In March 1990 Dr.Yoshihiro Takai joined us from Tohoku University for a year. He studied tumour radiobiology for 7 years at the Department of Radiation Biophysics at Tokyo University and is the author of over 20 publications. It is anticipated that later this year another Japanese Fellow, Dr.Inomata will join us in our research group.

In a recent lecture tour to Japan in 1989 I was honored to receive a gold medal from the University of Nihon in Tokyo in respect of the pion clinical research program in Vancouver.

Environmental Carcinogenesis Unit

SENIOR STAFF

H.F. Stich, Ph.D.
(Wurzburg)
Head,
Professor (Zoology, UBC)

A.J. Davison, Ph.D.
(Rutgers, N.J.)
Professor (Kinesiology, SFU)

B.P. Dunn, Ph.D.
(Brit. Col.)
Adjunct Professor
(Kinesiology, SFU)

M.P. Rosin, Ph.D.
(Toronto)
Associate Professor
(Kinesiology, SFU)

S.S. Tsang, Ph.D.
(Brit. Col.)
Honorary Assistant Professor
(Medical Genetics, UBC)

J.R. Vielkind, Ph.D.
(Giessen)
Assistant Professor
(Pathology, UBC)

THE PROLONGED MAINTENANCE OF POSITIVE INTERVENTION RESULTS BY BETA-CAROTENE OR VITAMIN A

Hans F. Stich (in cooperation with B. Mathew, R. Sankaranarayanan, M. Krishnan Nair and K.D. Brunnemann)

The chewing of tobacco, which increases the risk for oral cancer, is a worldwide habit engaged in by more than 450 million people in Asia and the South Pacific (tobacco-containing betel quids), 120 million Indians, Africans, Afghanistanis, Arabs and Soviets (tobacco/slaked lime mixtures), and by more than 30 million Americans and Europeans (snuff dipping). The prevention of this health hazard by dietary supplementation appears to be achievable. Epidemiological evidence points to a higher incidence of oral cancer in individuals deficient in vitamin A- or beta-carotene. Clinical trials with vitamin A, beta-carotene, or a mixture of both reduced the incidence of oral leukoplakias, and inhibited the formation of new precancerous oral lesions. The participants of the intervention trials were betel quid chewing fishermen of Kerala, India (11 chews/day), farmers in Luzon, the Philippines (4-15 chews/day), and snuff dipping Eskimos in Canada (8 dips/day for an average of 23 min. each). Since the chewing pattern did not change during the trial period, all participants remained exposed to tobacco-specific, carcinogenic nitrosamines and cancer promoters (catechol, arecoline), which are released from the chewing mixtures into the saliva. The frequency of oral leukoplakia, micronuclei in oral mucosal cells, and alterations in nuclear textures, as quantitated by image analysis, were used as endpoints. Administration of vitamin A (200,000 IU/week) for 6 months resulted in the complete remission of leukoplakias in 57% and a reduction of micronucleated cells in 96% of tobacco chewers. Beta-carotene (180

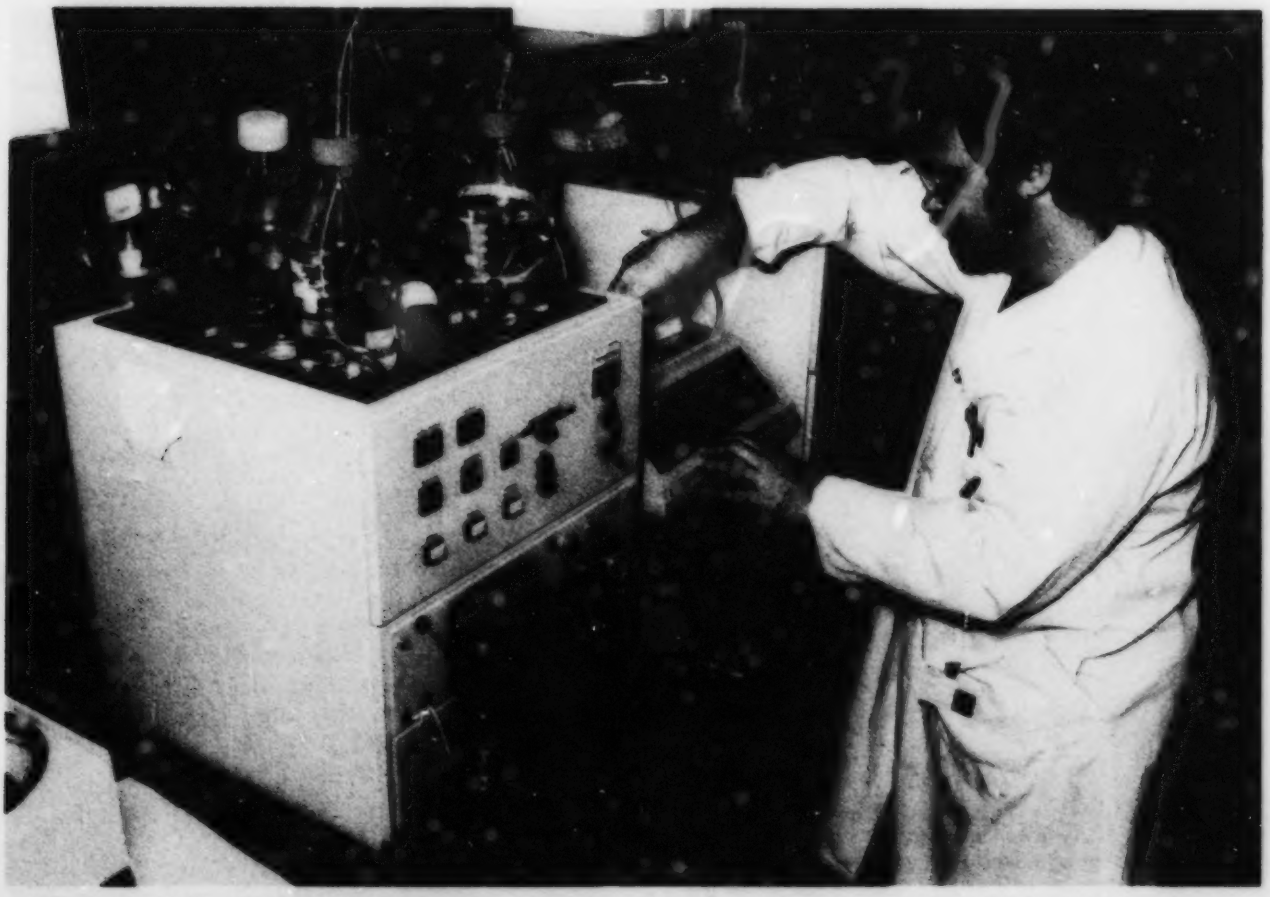
Dr. J.R. Vielkind, leader of a group studying an animal melanoma model, discusses evidence for the presence of a pigment cell recepter gene in animals forming melanomas, the Research Assistant Barbara Schmidt and Rachael Ritchie, a recipient of a Challenge 90 Summer Student Award.

mg/week) induced the remission of oral leukoplakias in 14.8% and a reduction of micronucleated cells in 98% of chewers. After the withdrawal of vitamin A or beta-carotene treatment, the oral leukoplakias reappeared, the frequency of micronuclei in the oral mucosa increased, and the nuclear textures reverted to those present prior to the administration of the chemopreventive agents. However, the protective effect of the original treatment could be maintained for an additional 8 to 12 months by the oral administration of lower doses of vitamin A (50,000 IU/week) or beta-carotene (60, 90 or 120 mg/week). Our current investigation focuses on the replacement of these maintenance doses of vitamin A or beta-carotene with an increased daily consumption of red palm oil or varieties of sweet potatoes rich in carotenoids, which would comprise a highly economical method for a chemopreventive approach in Third World countries.

MODULATING EFFECTS OF TUMOUR PROMOTERS AND RETINOIDS ON PAPILLOMAVIRUS-INDUCED CELL TRANSFORMATION

Dr Siu Sing Tsang

There is evidence pointing to the etiological role of papillomaviruses (PV) in human cancers, such as cervical and oral cancer. We are studying the mechanism by which PV induce cancerous change (cell transformation) in a cell. In our studies, bovine papillomavirus DNA (BPV DNA) was used to induce transformation in mouse fibroblasts. We have shown that BPV DNA was required for both the induction and maintenance of the neoplastic phenotype of a cell. Retinoids such as retinoic acid (RA) and retinol can prevent the expression of neoplastic phenotypes in BPV DNA-containing cells, and have an inhibitory effect on the replication of the viral DNA. Preliminary evidence suggests that after prolonged treatment with RA, cells become resistant to transformation by BPV DNA. Our results support the role of retinoids in the chemoprevention of cancer. As is the case for any therapy involving drugs, there is always the concern that the target cells may eventually develop resistance to the drugs and become non-responsive to their



John Fee uses a high pressure liquid chromatograph to isolate damaged genetic material from cells treated with a cancer causing chemical.

action. We are in the process of cloning BPV DNA transformed cells which are resistant to the action of RA. An understanding of the mechanisms by which these cells are refractory to RA should be important for the better clinical use of RA and other retinoids. Our other area of research deals with tumour promoters, which are chemicals that enhance tumour formation in animals previously exposed to carcinogens. We have found that certain tumour promoters act synergistically with BPV DNA to cause cell transformation. The enhancing effects of tumour promoters can be nullified by subsequent treatment of the cells with retinoids. The effect of retinoids and tumour promoters on the expression of viral and cellular oncogenes is being studied. Genes that are regulated by the retinoids and tumour promoters are being cloned. The BPV DNA cell transformation system promises to be a sensitive and rapid assay for the identification of tumour promoters, chemopreventive and chemotherapeutic agents. For example, a water extract of betel nut (chewers of betel nut/tobacco mixtures in India are at high risk for oral cancer) was found to enhance BPV DNA-induced cell transformation. Efforts are being directed towards the refinement and development of the assay. Researchers involved in these projects include Dr H.F. Stich, Paul Lam, Gang Li, and Linda Kowalski.

In collaboration with Drs Davison, Rosin and Zhang, and with graduate students Anna Li and Xuefeng Yin, we are studying the effect of oxidants on gene expression in mammalian cells and their ability to induce DNA breakage. One oxidant that we have studied is glossypol, which is being tested as a male contraceptive drug in China. The inhibitory effects of various antioxidants are being assessed. We have also investigated the effect of vanadium salts on cellular gene expression. Vanadium is a trace element which may play a role in the chemoprevention of cancer. By mimicking the effect of insulin, vanadium may have a clinical value in the treatment of patients suffering from diabetes.

CHROMOSOME BREAKING ACTIVITY IN THE URINE OF PESTICIDE SPRAYERS

Dr Bruce P. Dunn

We have previously developed methodology for isolating organic material from the urine of human subjects. This material can then be tested for its clastogenic (chromosome-breaking) properties using cultured mammalian cells. We have used this general methodology to examine orchard workers from the Okanagan who are occupationally exposed to pesticides while spraying fruit trees. Workers spraying a variety of pesticides were found to have elevated levels of clastogenic chemicals in their urine immediately after spraying. However, levels returned to baseline values overnight. The results suggest that urine monitoring may prove useful in assessing the exposure of workers to genotoxic materials.

GENETIC DAMAGE IN THE LUNGS OF SMOKERS AND NON-SMOKERS

Dr Bruce P. Dunn

We have developed sensitive 32P-postlabelling procedures which permit us to measure the covalent binding of environmental carcinogens to very small samples of DNA. We have analyzed tissue biopsies from a series of 78 patients undergoing routine diagnostic bronchoscopy. DNA from smokers exhibited elevated levels of aromatic DNA-carcinogen adducts. The chemical nature of the adducts is consistent with their originating from polycyclic aromatic hydrocarbons which are known to be present in cigarette smoke. Adduct levels were similar in tumour and non-tumour tissue and in bronchial and alveolar tissue. DNA-carcinogen adducts were detected in the lungs of ex-smokers who had recently stopped smoking, but were reduced to control levels in ex-smokers who had quit for several years. Alcohol consumption was associated with higher levels of DNA-carcinogen adducts. The data permit us for the first time to detect and measure the initial genetic damage caused by cigarette smoke in human subjects.

AN INTERNATIONAL STUDY ON PREVENTION OF THE PROMOTION PHASE OF CANCER DEVELOPMENT

Dr Miriam P. Rosin

Cancer development is a long-term process. Tumours may only become apparent 20 to 50 years after exposure to a carcinogenic agent. During this time the cells in the exposed tissue continue to undergo progressive change, finally leading to a visible tumour. Scientists have divided the process of cancer development into 3 phases: 1) the initiation phase, which involves an inheritable change to the genetic program of a cell in specific control gene(s); 2) the promotion phase, in which the "initiated" cell escapes from normal controlled cell division and begins to proliferate, producing new proteins, and starting to appear and behave abnormally; and 3) the progression phase, in which a small clinical tumour forms, grows by invading the tissue in which it is growing, and spreads via the blood and lymph systems throughout the body. Recently, scientists have begun to focus more attention on the second phase of carcinogenesis. If cells undergoing the second phase can be identified, either microscopically or biochemically, it may be possible to use this information to delineate which individuals in a population are at elevated risk for cancer, and to inhibit the further development of cancer in these individuals.

Dr Rosin and her colleagues have recently initiated an international project aimed at identifying changes occurring in human cells during the promotion phase. This study involves a research collaboration between the B.C. Cancer Research Centre and Ain Shams University in Cairo, Egypt. Dr Wagida Anwar (Cairo) and Dr Rosin are studying the changes that occur in the bladders of individuals with chronic infections from a parasite known as Schistosoma

haematobium. The people involved are farmers from a village who become infected with the parasite when working in irrigation canals. Females are also infected since they are exposed to the same parasite while washing clothes or household utensils. Children are exposed at an early age by swimming in the local water. The parasite causes extensive damage to the bladder of infected individuals, since eggs are continuously shed by the worm and pass through the bladder wall to be voided in the urine. The progressive changes occurring in the bladder are those observed in experimental laboratory animals during the promotion phase of cancer development. Not surprisingly, this bladder infection is a primary health concern for Egypt. Millions of individuals are infected by the parasite. Moreover, up to 40% of the cancers in this country are in the bladder, and these cancers occur predominantly among individuals with this infection. Dr Rosin and her colleagues are analyzing bladder cells collected from the urine of infected individuals in order to determine which potential biological markers can be used to identify promotion changes in humans. As an addendum to this study, the villagers are receiving treatment to eradicate the worm, in order to determine whether cellular changes produced during this promotion phase can be reversed. Future extensions of the project will involve a study of the effect of retinoid/beta-carotene supplementation on prevention of the damage produced in the bladder of infected individuals. In addition, a second study on a local Vancouver population with chronic bacterial infections in the bladder will be undertaken.

OXIDANTS AND ANTIOXIDANTS AS GENOTOXINS AND ANTICANCER AGENTS

Dr Allan J. Davison

Many cancers are preceded by several years of genetic damage by oxygen radicals. Strengthening the capabilities of the group in oygen mediated genotoxicity, Dr Davison was again seconded by Simon Fraser University to work with the Cancer Prevention Group in Epidemiology from January

Research Assistant Barbara Schmidt discusses the detection of melanoma genes in a pigment cell line with Research Associate Dr. Bahram Sadaghiani and Research Assistant Bruce Woolcock. The aim of this study is to learn more about the development of pigment cells and what happens to them when melanomas are formed. The incidence of melanoma, a serious form of skin cancer, is on the rise in our population.

to September 1989. Dr Davison was elected a Fellow of the Oxygen Society of the Americas in 1989, in recognition of his studies on the generation of the active states of oxygen that promote tumour formation in animals and humans. The efforts of Dr Jim Moon (a postdoctoral associate) and 7 graduate students have been crucial to the productivity of his research group. In 1989, the group published 5 papers and presented 12 papers at international conferences on the cellular production of oxygen radicals.

In Dr Davison's research group, graduate student Brian Bandy has recently published evidence that some cancers result from free radicals produced by damaged mitochondria. Mr Bandy is completing his doctoral thesis by measuring the impact of carcinogens on mitochondrial metabolism in cultured cells. Benzene is carcinogenic, since the body converts it to genotoxic metabolites. Luoping Zhang, another graduate student, has begun a collaboration with the University of California at Berkeley, which has started to show why benzene is carcinogenic. Some of the genetic abnormalities caused by benzene result from damage to the spindle apparatus which pulls the chromosomes apart when cells divide. Dr Davison was invited to an international conference in Stockholm in July to present findings that metals and free radicals produced from oxygen are crucial to the toxic actions of benzene metabolites.

We have shown a powerful antioxidant in carrot juice, and identified it as a metal chelating activity rather than a chain breaking antioxidant. James Wieber has been investigating the relationship between metal binding and chain breaking in antioxidant protection against oxygen radical generation. Beta-carotene is an antioxidant which protects animal and human cells against carcinogens. Graduate students Eunice Rousseau and Charles Tai are investigating synergism between carotene and vitamin C in protecting tissue components against tumour promoters. At a conference in Tubingen, Germany, Dr Davison reported the use of an enzyme, ornithine decarboxylase, as an indicator released by cells to show that they are responding to a tumour promoter. Of 7 phenolic food components, 4 were tumour promoters based on this criterion, and 3 protected against tumour promoters. This work was done by Dolores Fatur in collaboration with Dr Tsang as part of her M.Sc. thesis. Many researchers consider that the best prospects for the prevention of cancer lie in the use of chemopreventive diets or supplements during the years of exposure to oxygen radicals which precede the appearance of most cancers. Much research remains to be done before effective anti-cancer supplements can be recommended with confidence.

FISH MELANOMA AND CELL DEVELOPMENT

Dr Juergen R. Vielkind

Melanoma in humans is increasing at a rate exceeded only by lung cancer, and has a mortality rate of 65% for all skin cancer patients. Melanoma is very difficult to treat, either by chemotherapy or by other methods. Understanding melanoma formation at its basic level may permit the development of better strategies for treatment.

We have concentrated on a genetically defined in vivo melanoma model (platyfish-swordtail model) as a surrogate for familial human melanoma. In humans, several structural chromosomal abnormalities have been identified which affect chromosomes 1, 6, 7 and 11, but no distinct genetic culprit has been found. In our model, we have identified and now molecularly cloned a gene that plays a major role in melanoma formation. Interestingly, in order to obtain melanomas, this gene must be duplicated, and stretches over a very long distance of DNA. Obviously, it is important to decipher this long, duplicated stretch of DNA in order to decipher melanoma formation. A very similar gene has recently been found to be implicated in the formation of human pigment cells and mammary tumours; a probe from our gene detects several fragments in digested human genomic DNA. Given the similarity between our model and human melanoma, findings can be anticipated which could identify one of the genetic factors which mediate human familial melanoma formation. We have therefore teamed up with the melanoma group at the University of Alberta in Edmonton, and are further searching for melanoma-specific genes and/or antigen markers. Research staff involved in these studies include research associate, Dr Bahram Sadaghiani, and research assistants Barbara Schmidt and Bruce Woolcock. We gratefully acknowledge support from the B.C. Cancer Foundation, the Medical Research Council of Canada, and the National Institutes of Health (U.S.).

Terry Fox Laboratory

SENIOR STAFF

A.C. Eaves, B.Sc. (Acadia), M.Sc., M.D. (Dalhousie), Ph.D. (Toronto), FRCP(C), FACP
Director, Terry Fox Laboratory and Stem Cell Assay Service; Head, Division of Hematology, B.C. Cancer Agency, VGH and UBC; Professor, Departments of Medicine and Pathology, UBC.

C.J. Eaves, B.A., M.Sc. (Queen's), Ph.D. (Manchester, Great Britain)
Deputy Director, Terry Fox Laboratory; Professor, Department of Medical Genetics, UBC; Terry Fox Cancer Research Scientist of the NCI(C).

D.E. Hogge, M.D. (Alberta), Ph.D. (UBC), FRCP(C)
Senior Scientist, Terry Fox Laboratory; Director, Cell Separator Unit, VGH; Assistant Professor, Department of Medicine, UBC.

R.K. Humphries, B.Sc. (Alberta), M.Sc. (Toronto), M.D., Ph.D. (UBC)
Senior Scientist, Terry Fox Laboratory; Associate Professor, Department of Medicine, UBC; MRC Research Scholar.

D.K. Kalousek, M.D. (Czechoslovakia), FRCP(C), FCCMG
Senior Scientist, Terry Fox Laboratory; Associate Professor, Department of Pathology, UBC.

H. Klingemann, M.D. (Wuerzburg, Germany)
Senior Scientist, Terry Fox Laboratory; Clinical Hematologist, B.C. Cancer Agency and VGH; Member, Leukemia/Bone Marrow Transplant Program of B.C.; Clinical Associate Professor, Department of Medicine, UBC.

G. Krystal, B.Sc., M.Sc., Ph.D. (McGill)
Senior Scientist, Terry Fox Laboratory; Associate Professor, Department of Pathology, UBC; NCI(C) Senior Research Scientist.

P.M. Lansdorp, M.D., Ph.D. (Amsterdam, Netherlands)
Senior Scientist and Director of the Cryogenic Laboratory, Terry Fox Laboratory; Clinical Assistant Professor, Department of Medicine, UBC.

D.L. Mager, B.Sc. (Nebraska, USA), M.Sc., Ph.D. (Toronto)
Senior Scientist, Terry Fox Laboratory; Assistant Professor, Department of Medical Genetics, UBC; MRC Research Scholar.

F. Takei, B.Sc. (Tokyo, Japan), Ph.D. (UBC)
Senior Scientist, Terry Fox Laboratory; Associate Professor, Department of Pathology, UBC.

ASSOCIATE STAFF

M. Barnett, M.D. (Nottingham, Great Britain), MRCP (London, Great Britain)
Associate Member, Terry Fox Laboratory; Clinical Hematologist, B.C. Cancer Agency and VGH; Member, Leukemia/Bone Marrow Transplant Program of B.C.; Clinical Assistant Professor, Department of Medicine, UBC.

G. Phillips, M.D. (Oklahoma, USA), ABIM (St. Louis, USA)
Associate Member, Terry Fox Laboratory; Clinical Hematologist, B.C. Cancer Agency and VGH; Director, B.C. Leukemia/Bone Marrow Transplantation Program; Professor, Department of Medicine, UBC.

D.E. Reece, M.D. (Houston, USA), FRCP(C)
Associate Member, Terry Fox Laboratory; Clinical Hematologist, B.C. Cancer Agency and VGH; Deputy Director, B.C. Leukemia/Bone Marrow Transplantation Program; Clinical Assistant Professor, Department of Medicine, UBC.

J.D. Shepherd, M.D. (Calgary), FRCP(C)
Associate Member, Terry Fox Laboratory; Clinical Hematologist, B.C. Cancer Agency and VGH; Member, Leukemia/Bone Marrow Transplant Program of B.C.; Clinical Assistant Professor, Department of Medicine, UBC.

VISITING SCIENTIST

B. Swolin, M.D. (Gothenburg, Sweden), Ph.D. (Gothenburg, Sweden)
Associate Professor and Hematopathologist, Department of Clinical Chemistry, Gothenburg University, Gothenburg, Sweden.

Dr. Shona Dougherty (seated), a winner of a fellowship from the National Cancer Institute of Canada, discusses her work on bone marrow stromal cells with Drs. Connie and Allen Eaves.

POSTDOCTORAL FELLOWS

M. Alai, Ph.D.
Fellow/Staff Member, SFU

J. Cashman, Ph.D.
NCI Grant Funded

R. Cutler, Ph.D.
NCI Grant Funded

P. de Vries, Ph.D.
Cancer Research Society Fellow

G. Dougherty, Ph.D
NCI Grant Funded

S. Dougherty, M.B., Ch.B.
NCI Fellow

J-H. Gong, Ph.D.
MRC Grant Funded

M. Hough, Ph.D.
BCHCRF/MRC Grant Funded

P. Hughes, M.D., FRCP(C)
Terry Fox Fellow

R. Kay, Ph.D.
MRC Fellow

C. Kelleher, Ph.D.
NCI/MRC Grant Funded

H. Klein, M.D.
Deutsche Forschungsge Fellow

F. Kohn, Ph.D.
MRC Grant Funded

D. Lee, Ph.D.
MRC Grant Funded

T. Otsuka, M.D.
Terry Fox Fellow

C. Schmitt, Ph.D.
INSERM Fellow

H. Sutherland, M.D., FRCP(C)
Terry Fox Fellow

T. Thomas, M.D., Ph.D.
BCHCRF Grant Funded

A. Turhan, M.D., CES
MRC Fellow

C. Udomsakdi, M.D.
Cancer Research Society Fellow

C. Vissinga, Ph.D.
MRC Grant Funded

B. Wognum, Ph.D.
NCI Grant Funded

S. Wong, Ph.D.
MRC Grant Funded

GRADUATE STUDENTS

C. Carpenito, Ph.D. Student
Medical Genetics, UBC
MRC Studentship

W. Craig, M.Sc. Student
Medical Genetics, UBC MRC Studentship

H. Dickeson, M.Sc. Student
Pathology, UBC
NCI Grant Funded

A. Feuchter, Ph.D. Student
Medical Genetics, UBC NCI Studentship

C. Fraser, Ph.D. Student
Medical Genetics, UBC NCI Studentship

N. Goodchild, Ph.D. Student,
Medical Genetics, UBC
MRC Studentship

K. Horley, Ph.D. Student
Microbiology, UBC NSERC Studentship

A. Ingram, M.Sc. Student
Pathology, UBC MRC Grant Funded

J. Krosl, Ph.D. Student Medical Genetics, UBC Yugoslavian Government Studentship

A. Mui, Ph.D. Student
Pathology, UBC MRC Studentship

N. Poulin, Ph.D. Student
Physics, UBC NCI Grant Funded

S. Szilvassy, Ph.D. Student
Microbiology, UBC NCI Studentship

D. Thacker, Ph.D. Student
Medical Genetics, UBC UGF Studentship

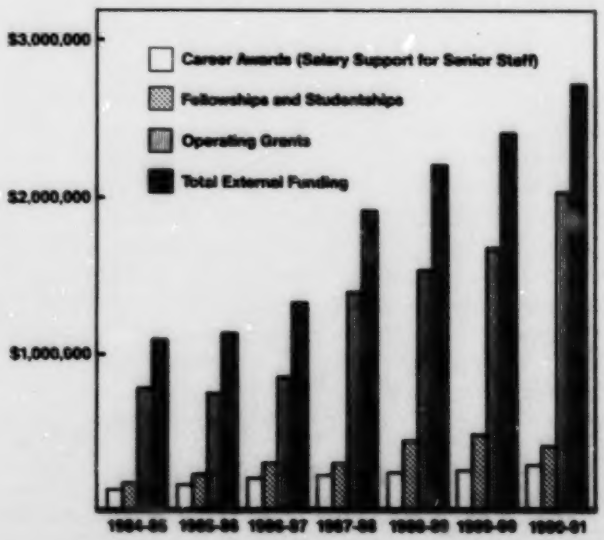
D. Wilkinson, Ph.D. Student
Medical Genetics, UBC
MRC Studentship

Overview

The primary goal of the research undertaken in the Terry Fox Laboratory is to improve the diagnosis and treatment of leukemia and related types of cancer. To achieve this, a multi-disciplinary group of laboratory cancer researchers and physicians of the Leukemia/ Bone Marrow Transplant Program have been brought together under one administrative structure. Thus advances made in the laboratory can be moved quickly into the clinic. Conversely, patient blood and marrow specimens needed for laboratory research are readily available. The net result is that progress in both the clinic and in the laboratory can be made more rapidly.

A major part of the funding for the research done by the more than 100 people now working in the Terry Fox Laboratory comes from a prestigious 5 year Group grant from the National Cancer Institute of Canada. Significant support has also been received from the Medical Research Council of Canada, the British Columbia Health Care Research Foundation, the National Institutes of Health (USA), the Cancer Research Society and the British Columbia Medical Services Foundation (administered through the Vancouver Foundation). The total amount of funding received from outside peer-reviewed sources in 1989-90 was $2,414,585 and for 1990-91 has already reached $2,675,100 (see graph).

Several Senior Staff hold competitive career awards for salary support from the National Cancer Institute and from the Medical Research Council. Salary support for the other Senior Staff is provided by the BC Cancer Agency, Vancouver General Hospital, BC Children's Hospital and University of British Columbia. A large and important group in terms of research productivity are the 43 postdoctoral fellows, graduate students, and summer students who have worked on projects in the Terry Fox



Research funds obtained by the staff of the Terry Fox Laboratory from external, peer-review, granting agencies.

Laboratory during the last year. 24 of these individuals have also obtained their own full-time salary support in the form of competitive independent awards from outside agencies, including the National Cancer Institute, Medical Research Council, National Science and Engineering Research Council, University of British Columbia, L'Association pour la Recherche contre le Cancer (France), and the Cancer Research Society.

Teaching is also a vital part of cancer research, especially in view of recent governmental projections of increasing numbers of cancer patients and insufficient numbers of trained biomedical investigators in the near future. Most graduate students in the Terry Fox Laboratory are enrolled either in the Genetics Program, the Experimental Pathology Program or the Department of Microbiology of the University of British Columbia. The Senior Staff of the Terry Fox Laboratory has organized, with the assistance of other staff in the BC Cancer Research Centre, a joint graduate and undergraduate level course called Oncogenetics at the University of British Columbia. Dr. Dixie Mager now serves as the Co-ordinator for this very popular course which provides an introduction to the rapidly evolving field of cancer cell biology and genetics. In addition a number of University accredited seminar courses are also offered within the Terry Fox Laboratory itself.

The Senior Staff have had a busy and productive year in terms of invited lectures, publications and attendance at national and international meetings. Many of the Senior Staff also serve on peer-review grants panels including those of the National Cancer Institute, the Medical Research Council, the B.C. Health Care Research Foundation, the Alberta Cancer Board, and the Canadian Red Cross, as well as the National Institutes of Health of the United States. Several of the Senior Staff are also Associate Editors or members of editorial boards of various international journals.

LEUKEMIA LABORATORY

Dr. A. Eaves

A variety of malignancies involving cells of the hemopoietic system are now recognized. These diseases differ in the patient age group where they are most often seen and the type of therapy to which they respond. They also differ in a number of more fundamental biological parameters, including the type of stem cell initially transformed, oncogenes involved, altered responses to growth regulators and the capacity of the transformed cells to undergo terminal differentiation. Nevertheless all hemopoietic malignancies appear to represent the clonal amplification of single cells, whose growth is accompanied by suppression of the growth and differentiation of residual normal elements. In addition the malignant cells appear genetically unstable and undergo clonal evolution leading to the formation of more aggressive subpopulations.

The research objectives are to develop in vitro systems to allow features of leukemic hemopoiesis to be reproduced, analyzed and eventually manipulated under defined conditions. At present efforts are focussed on progenitor cells from patients with polycythemia vera, chronic myeloid leukemia, essential thrombocytosis, acute myeloid leukemia, and the myelodysplastic (pre-leukemic) syndromes. Recently, we have shown how both in vitro and molecular methods can be used to demonstrate the presence of normal stem cells in the marrow of patients with obvious disease and that the balance in favour of normal hemopoiesis can be altered in vitro.

One of the systems in which normal hemopoiesis is favoured is now being evaluated as a method to prepare leukemic autografts for use in patient treatment protocols requiring marrow rescue ("culture purging"). The potential and mechanisms by which growth factor therapy in vivo enhances hematologic recovery after bone marrow transplantation is also being studied. Assays to detect and characterize human leukemic stem cells in vitro are being developed and new models of human disease using human oncogenes are being explored.

CELL CULTURE LABORATORY

Dr. C. Eaves

Experiments in this laboratory and elsewhere have established the existence in adults (both mouse and man) of primitive hemopoietic cells capable of regenerating all myeloid and lymphoid lineages following the transplantation of these cells into marrow-ablated recipients. Nevertheless quantitative assays to allow the purification and characterization of these cells and to allow investigation of how their proliferation and differentiation are controlled, are not yet established. A major goal of the work in this laboratory is to develop and validate such assays based on the expression by these cells of their developmental potential both in vitro and in vivo.

We have recently devised a limiting dilution assay for long-term totipotent repopulating cells in the mouse and have begun to define their properties. These cells can be sustained in long-term marrow cultures for several weeks and can be genetically manipulated. Ongoing investigations are focussed on the purification of this cell to homogeneity, and analysis of the molecular and cellular mechanisms that regulate its turnover, expansion, recruitment to differentiate, and transformation both in vitro and in vivo, in collaboration with other senior staff of the Terry Fox Laboratory. We have also developed a quantitative assay for a very primitive cell type in human bone marrow. This cell is detected by virtue of its ability in the presence of appropriate mesenchymal feeders to give rise to pluripotent as well as lineage-restricted hemopoietic progenitor cells detectable in standard clonogenic assays. Investigations are continuing to characterize this

"long-term culture initiating cell" and to explore its potential for lympho-myelopoiesis. This is requiring the development of new systems for supporting the earliest stages of human lymphopoiesis, either in genetically immuno-compromised mice or in vitro.

Studies to define the molecular interactions required for the generation and differentiation in vitro of murine pre-B cells are also underway. Evidence for a new growth factor involved in this process has been obtained and further characterization of this factor is on-going. The role of IL-7 and integrins in the regulation of early murine and human pre-B cell development is also being analyzed.

MOLECULAR ONCOLOGY LABORATORY
Dr. D. Hogge

The maintenance of adequate numbers of functional blood cells is a complex process involving regulation of cell growth, maturation and ultimately cell death. The way in which the orderly production of these cells is controlled in vivo is unknown although many putative regulators have now been identified. Normal responses to these growth factors are often perturbed in leukemic blood cells and disordered regulation of cell proliferation and maturation are hallmarks of all hematologic malignancies. The goal is to understand the regulatory mechanisms that govern normal hemopoiesis and the abnormalities that result in leukemic transformation.

Retroviral mediated gene transfer is an efficient and nontoxic way of introducing foreign genetic material into human hemopoietic cells. We have constructed a series of retroviral plasmid vectors containing genes for several human hemopoietic growth factors and have used these to genetically engineer cells to constitutively produce high levels of specific factors. Infected cells are now being studied for the consequences of expression of such retrovirally transferred genes. For example, primitive hemopoietic cells that normally respond to but do not produce IL-3, may be genetically engineered to make this factor (become autocrine), and the effect of this change on their growth potential thus specifically examined.

Marrow stromal cells also have been engineered to continuously produce high levels of various regulatory factors. These "feeders" are now being tested for their ability to support and/or alter the growth of primitive normal and malignant hemopoietic cells. The natural expression of specific growth factor genes by individual cells in the marrow microenvironment, where hemopoiesis normally occurs, will be investigated using in situ hybridization.

Finally, in collaboration with others at the Terry Fox Laboratory the technique of retroviral gene transfer is being applied to the marking of primitive human hemopoietic cells in order to follow their subsequent fate both in vitro and in vivo. These studies are the forerunners of clinical trials now being designed which will be aimed at improving the results of marrow transplantation in man using gene transfer.

MOLECULAR GENETICS LABORATORY
Dr. K. Humphries

Recently developed gene cloning and transfer techniques are being used to define new properties of primitive hemopoietic stem cells and the mechanisms that determine their growth. The ultimate goal is to develop and implement protocols for the clinical use of genetically manipulated marrow stem cells.

We are currently using recombinant retroviruses as transfer vectors, both to genetically mark hemopoietic cells ("fate mapping") and to examine the function of putative regulatory genes. Effective gene transfer to highly purified and very primitive hemopoietic murine repopulating cells has been achieved and we have used gene transfer to show that the proliferation of such cells can be supported in vitro. Efforts will now focus on the definition of factors controlling stem cell growth and the development of models of leukemic transformation. Gene transfer is also being used to study the function of newly cloned genes such as receptors for specific hemopoietic growth factors. In addition to contributing to an understanding of hemopoietic regulation, this work will provide a basis for future attempts at gene therapy based on the modification of bone marrow cells.

Also ongoing are efforts to discover new candidate regulatory genes by cDNA expression cloning. This approach is well suited to the isolation of genes encoding

Dr. Keith Humphries adjusts equipment used to microinject DNA into the nucleus of cells under the watchful eye of Dr. Margaret Hough, a postdoctoral fellow working on transgenic mice.

as yet undefined cell surface molecules that play critical roles in determining growth factor responsiveness (eg, receptors) or in mediating cell-cell and cell-matrix interactions (eg, adhesion molecules). Currently the products of three such recently cloned genes are being studied using recombinant DNA and biochemical approaches to gain further insight into their function. For example, murine M1/69 has an intriguing pattern of expression correlated with key stages of T and B cell development and characterization of the recently cloned human homologue of this gene is now being pursued.

Newer initiatives involve the development of microinjection techniques for gene transfer to somatic cells (hemopoietic stem cells and stromal cells) and the establishment of a transgenic mouse facility. Both of these techniques are now being used for the characterization of various hemopoietic regulatory genes in collaboration with other members of the Terry Fox Laboratory.

CYTOGENETICS LABORATORY

Dr. D. Kalousek

Chromosomal changes play an integral part in the development of most blood cell cancers. Both in leukemia and lymphoma, the correlation between the malignant cell phenotype and a specific chromosomal abnormality is recognized.

The focus of the Cytogenetics Laboratory is to understand the stage in the evolution of a leukemic clone at which chromosomal changes occur, the cell type in which these first take place, and possible associations with subsequently manifested changes in growth and differentiation.

A method for harvesting tiny individual colonies of developing blood cells produced in tissue culture has been developed in this laboratory. This has revolutionized our ability to study particular cell types and to obtain much more precise information about chromosomally abnormal cells in patients with leukemia. We are now devoting most of our efforts to a joint clinical trial using "culture-purged" autologous marrow transplants to try to achieve cures in patients with chronic myelogenous leukemia, where cytogenetic evaluation of the cells is a key part of the procedures.

TRANSPLANTATION BIOLOGY LABORATORY

Dr. H. Klingemann

Bone marrow transplantation (BMT) allows the cure of a substantial proportion of patients with hematological diseases. In the remainder relapse is the major problem, indicating that treatment protocols are still not adequate in all cases. Relapse rates are higher when autologous (the patient's own) marrow is transplanted than when allogeneic marrow from a family member or unrelated person is used. However, in the latter case, graft-versus-host disease (GVHD) frequently develops. GVHD is mediated by co-transplanted alloreactive T-lymphocytes, cytotoxic T-cells and the release of cytokines such as tumor necrosis factor and certain interleukins. On the other hand, GVHD is believed to provide some anti-leukemia effect, thereby accounting for the lower relapse rates characteristic of patients who exhibit GVHD.

The major objective is to develop clinically practical strategies to overcome residual disease in patients treated with marrow transplant protocols. Current experiments are directed at dissecting mechanisms of GVHD with the ultimate goal of designing therapies that deliver the anti-leukemic effects with minimal damage to normal tissue. We are currently exploring methods for activating monocytes so that they may be more effective in killing leukemic cells. Mechanisms of monocyte cytotoxicity, (eg, by production of secreted or cell surface bound tumor necrosis factor) are also under study as is the importance of adhesive interactions in the recognition and killing of leukemic cells by monocytes and macrophages. Since it is known that adhesion receptors (integrins) can be altered on leukemic cells, strategies for overcoming potentially defective monocyte/leukemic cell interactions are being examined as a method to enhance the elimination of residual disease.

Natural killer (NK) cells are another population capable of mediating anti-leukemia activity, especially if they are stimulated to develop into lymphokine-activated killer (LAK) cells. We are currently exploring the possibility of inducing "LAK cell killing" of leukemic cells in clinical autologous marrow transplants by in vitro incubation of the marrow with interleukin-2 prior to transplantation. We are also trying to isolate, clone and manipulate donor-derived NK cells from recipients after BMT to test whether they can kill autologous leukemic cells. This cell population could then also be used as targets for future immune transplant and gene transfer experiments.

BIOCHEMISTRY LABORATORY

Dr. G. Krystal

Over the last decade, more than a dozen growth factors and inhibitors that appear to regulate the normal processes of blood cell development have been identified. These factors are now known to exert their effects as a result of binding to specific high affinity receptors expressed on the surface of responsive target cells. Recently, several of these receptors have been cloned (ie, receptors for erythropoietin (Ep), granulocyte-macrophage colony stimulating factor (GM-CSF), granulocyte-colony stimulating factor (G-CSF), and the interleukins, IL-1, IL-2, IL-3, IL-4, IL-6, and IL-7). Many have been found to share structural features suggestive of a common ancestral origin. Interestingly, all of these receptors lack a tyrosine kinase domain indicating that the signals they induce involve mechanisms distinct from those of other cytokine receptors (eg, for epidermal growth factor and

Dr. Gerald Krystal (centre) discusses the latest results on the Interleukin-3 receptor with Dr. Rob Cutler, a postdoctoral fellow from Australia, and Alice Mui, winner of an MRC studentship.

platelet derived growth factor) that possess intrinsic tyrosine kinase activity.

A major goal of the research is to delineate the mechanisms of signal transduction utilized by this new receptor family. One approach is to isolate proteins that may be closely associated with a given receptor and hence co-purify with it. This strategy is currently being applied to receptors for Ep, IL-3 and GM-CSF. Antibodies to various candidate proteins are also being utilized to determine if proteins similar to those associated with tyrosine kinase containing receptors are employed by these receptors.

Another approach relies on developing a cell-free system in which isolated nuclei are re-combined with cytosols and plasma membranes from other cells. For example, by mixing plasma membranes and cytosols from factor-stimulated cells with nuclei from quiescent cells, it should be possible to develop assays for molecular intermediates that lead to specific alterations in gene expression and hence allow the further purification, cloning and manipulation of these molecules. This system thus offers a powerful and new strategy for analyzing the process of signal transduction at the subcellular level.

CRYOGENIC LABORATORY
Dr. P. Lansdorp

The primary goal of the studies being pursued in this laboratory is to develop practical and efficient methods for isolating and characterizing human hemopoietic stem cells. For this purpose a precise lineage map of cell surface molecule expression on hemopoietic cells is being developed using multi-color immunofluorescence staining techniques and 5-parameter flow cytometry. Very sensitive techniques to measure the simultaneous expression of growth factor receptors as well as cell surface antigens defined by monoclonal antibodies have been developed and are used for these studies. These techniques use novel monoclonal antibodies specific for the fluorescent protein phycoerythrin. Mapping of cell surface antigens on immature hemopoietic cells is greatly facilitated using directly labeled monoclonal antibodies against CD34 recently developed in the lab. CD34 is a 110kd glycoprotein that is expressed on only a few percent of nucleated bone marrow cells including all known hemopoietic progenitor cells. New monoclonal antibodies are being generated to fill in the blanks of the lineage map and candidate stem cells are being identified on the basis of their cell surface composition. Such CD34 subpopulations are sorted using the TFL dual laser FACStar+ cell sorter and then tested in a variety of functional assays.

In addition, large scale stem cell purification techniques are being developed for applications in bone marrow transplantation. In principle, the use of purified stem cells offers a single, widely applicable approach to circumventing the varied problems of contaminating lymphocytes in allogeneic marrow transplants or contaminating tumor cells in autologous marrow transplants. Pure stem cells will also facilitate crucial studies of gene therapy that may be needed to combat chemotherapy resistant malignancies and AIDS.

An effort is also being made to define culture conditions that will support the immediate activation and proliferation of highly purified stem cells using time-lapse videomicroscopy to assess the behaviour of individual cells and analysis of changes in their membrane marker phenotype. These approaches can be used to systematically analyze a variety of culture conditions, eg, combinations of growth factors, extracellular matrix proteins, feeder cells and other stimulatory/inhibitory molecules such as monoclonal antibodies.

MOLECULAR BIOLOGY LABORATORY
Dr. D. Mager

The general goal is to analyze the structure of genes and genomes, and to identify processes that contribute to genomic variability, gene regulation and genetic abnormalities. Currently, a major aim is to determine the impact that endogenous retrovirus-like sequences or retrotransposons have on the human genome. Retrotransposons are a significant source of genetic change in lower organisms, causing both insertional gene mutations and more complex chromosomal rearrangements. In humans and other mammals, DNA sequences which resemble retrotransposons comprise at least 10% of the genome and it has been postulated that rearrangements or mobilization of such elements contribute to aging, malignancy and birth defects, and may also have a beneficial role by increasing genetic diversity.

Much of the present research is focussed on a large family of human retrovirus-like elements termed RTVL-H. These elements are dispersed on all chromosomes and comprise 0.2% of total human DNA. Considerable emphasis is being placed on studies of the expression of RTVL-H sequences during development, differentiation and malignancy and on the identification of potential protein products encoded by these elements. In addition, transcriptional regulatory sequences (promoters, enhancers and polyadenylation signals) found in RTVL-H long terminal repeats (LTRs), and factors controlling LTR activity, are being analyzed. Heterologous human genes that are regulated by adjacent RTVL-H LTRs are also being isolated and characterized. In other studies we are analyzing the apparent association between a cluster of RTVL-H elements on the long arm of chromosome 7(7q) and common 7q deletions in leukemia, and we are developing novel strategies to detect transposition intermediates and new insertional events in human cells.

Also being investigated is the possibility that activation of endogenous retroviruses may account for the unusually high mutation rate seen in a specific mouse strain isolated at UBC (in collaboration with other faculty in the Department of Medical Genetics). A joint study with Dr. Fumio Takei in the Terry Fox Laboratory is also in progress to elucidate the gene organization and functional role of a novel mouse multi-gene family which shows different genomic arrangements in different mouse strains.

Dr. Fumio Takei examines a DNA sequencing gel with Michael Butchart, a summer student from UBC who is planning a career in cancer research.

IMMUNOLOGY LABORATORY

Dr. F. Takei

T cells play a central role in the immune system. They can become the cytotoxic cells that kill virus-infected cells, helper cells that cooperate with B cells in antibody production and they can be stimulated to produce various lymphokines that influence many other cell types. The long-term goal of the research is to understand the mechanisms that regulate the generation of functional T cells and to eventually utilize such knowledge to manipulate immune responses for therapeutic advantage. There are two important steps in T cell differentiation processes that determine the specificities and functions of T cells. The first is the expression of antigen-specific receptors on T cells that then allows the selection of T cells with appropriate specificities. The second step is the activation of resting mature T cells. Research is focussed on both of these critical steps in the development of functional T cells. This involves a combination of immunological, biochemical and molecular biological approaches to identify and characterize the molecules and the genes that regulate these processes.

One project is concerned with analyzing the process of T cell development that takes place within the thymus. The earliest steps of T cell development involving the rearrangement of the T cell receptor genes and the surface expression of the receptor proteins appears to require cell-cell interactions between T cell precursors and thymic non-lymphoid cells. We are currently attempting to characterize the cells and the surface molecules that participate in this interaction. We have also recently identified a novel T cell population that responds to IL-7. The functional role of this T cell population is currently being determined.

A second project is focussed on characterizing molecules that are expressed on the surface of T cells and are involved in their interaction with other cells. Of particular interest are adhesion molecules. One of these, MALA-2, the murine equivalent of ICAM-1, has been identified and cloned in our laboratory. We are now investigating the role of MALA-2 in the immune system, regulation of MALA-2 gene expression, and structure-function relationships of MALA-2. Other cell adhesion molecules will be similarly studied by a combination of gene cloning and immunological/biochemical characterization approaches.

Cancer Endocrinology

SENIOR STAFF

Dr. Charles Beer
Senior Scientist

Dr. Nicholas Bruchovsky
Head,
Department

Helen Cheng
Research Assistant

Kelly Fox
Research Assistant

Dr. Larry Goldenberg
Consultant Urologist

Dr. Peter Gout
Senior Scientist

Dr. Edward C. Jones
Consultant Pathologist

Nasrin M. Mawji
Research Assistant

Nasrin (Rina) Mawji
Research Assistant

Dr. Robert Noble
Senior Scientist

Navdeep Otal
Research Assistant

Dr. Paul Rennie
Senior Scientist

Dr. Bahram Sadaghiani
Research Associate

Barbara Schmidt
Research Assistant

Dr. Rob Snoek
Lab Supervisor

Dr. Juergen Vielkind
Senior Research Scientist

Cynthia Wells
Senior Secretary

Bruce Woolcock
Research Assistant

The function of this section is to evaluate the results of hormone therapy; to develop new ways of employing hormones, anti-hormones and other factors which regulate the endocrine glands; and to make recommendations concerning the future use of such agents for the management of cancers of the breast, prostate and endometrium. These malignancies present a major challenge to the resources of the British Columbia Cancer Agency owing to their high incidence and prevalence. Currently, there are approximately 13,000 women with breast cancer and 7,500 men with prostate cancer in the province. In addition about 1500 new cases of breast cancer and 1600 of prostate cancer are diagnosed each year (1987 statistics); due to demographic changes in the population the number of new cases is expected to increase by about 50% in the next decade. The majority of such patients will receive some form of endocrine therapy during their treatment history. Increasingly, sophisticated new technologies are being used to assess the potential danger of pre-malignant lesions and the risk of metastatic disease in early malignancy. The section has made a major commitment to the development of such procedures which, when implemented, will enhance the medical and economic benefits of future therapies. More emphasis will be placed on prevention of malignant progression and early intervention - therapeutic refinements which should help to check the rising prevalence rates.

Nasrin Mawji of Cancer Endocrinology is seen running an agarose gel to analyze the 5 -Reductase gene which is used to study expression of 5 -Reductase in patients with benign prostatic hyperplasia and cancer of the prostate.

The section is engaged in a number of basic and applied investigational projects which include the following studies: mechanism of action of testosterone; control of neoplastic growth by androgens and other hormones; cellular mechanisms of tumour progression focusing on autocrine growth factors; markers of androgen action in human prostate and their potential use in the clinical assessment of prostatic carcinoma; stromal-epithelial interactions in the pathogenesis of benign prostatic hyperplasia; relationship between androgen receptors and plasminogen activator in prostatic carcinoma; use of anti-androgens in the treatment of advanced prostatic carcinoma; use of 5 alpha-reductase inhibitors in the treatment of prostatic carcinoma; the study of the role of hormones of the anterior pituitary in the growth of malignant lymphomas; an investigation of the biological and biochemical changes occurring in malignant lymphomas as they progress from hormonal dependency to autonomy; and the evaluation of risk of malignancy using flow cytometer and oncogene screening.

Currently, the section is devoting much of its effort to completing the ground work for the establishment of an Oncogene Diagnosis Service focusing on the application of flow cytometry and oncogene screening to the assessment of carcinomas of the prostate, breast and cervix. There is considerable evidence linking the inappropriate activation of certain normal human genes, termed proto-oncogenes, to the development and spread of cancer. In particular, a strong correlation between the aberrant formation of multiple copies of specific oncogenes (gene amplification) and poor prognosis (i.e. a shorter time to relapse and a lower survival rate) has been well documented in neuroblastomas, small cell lung carcinoma, and breast carcinoma. The screening of these cancer-related genes will initially involve measurement of the N-myc oncogene in neuroblastomas, the c-myc oncogene in small cell lung carcinoma and the HER-2/neu oncogene in breast carcinoma. In addition, it is anticipated that the Oncogene Diagnosis Service will provide an environment that will facilitate the immediate implementation of new prognostic tests in this rapidly developing area. One such breakthrough with major clinical ramifications is the discovery of a gene that confers multiple drug resistance upon a cancer cell. Since the expression of this gene in a breast cancer would signify that the tumour will not respond to cytotoxic drugs, the selection of candidates for adjuvant chemotherapy could be done with greater precision while alternative treatments affording a better outlook could be offered much sooner to women with drug resistant cancer.

The section continues to devote much of its effort to the development, testing and application of new drugs which have clinical potential in the treatment of prostate carcinoma. As long as the cancer remains confined to the prostate it is curable by surgery but in 50-60% of cases it has already spread outside the gland at the time of diagnosis and more complex therapy is necessary to control it and lengthen survival. Investigations conducted by the section have shown that the effectiveness of the anti-androgen, cyproterone acetate, is enhanced by the co-administration of a small dose of diethylstilbestrol (synthetic female sex hormone) which acts synergistically with cyproterone acetate to suppress the pituitary gland. In clinical testing the combined therapy produced an objective response rate of 98% with survival of 80% of patients after 1 year and 50% after 2 years. Such treatment offers the advantage of a prompt onset of action with a high probability of gaining benefit in terms of symptomatic improvement. The treatment has also been shown to be one of the most cost-effective in the treatment of prostate cancer. In the first Canadian trial of a new long-acting LHRH agonist, ICI 118630, the section is determining if the incidence of side-effects associated with the use of cyproterone acetate and low-dose diethylstilbestrol can be reduced by substituting ICI 118630 for diethylstilbestrol in the long-term treatment of advanced prostate cancer with multiple hormonal agents. This assumption appears to be correct since virtually no side effects associated with the use of diethylstilbestrol have been observed in the patients entered into the trial.

Even though all prostate cancer cells should be killed by such treatment, it is inevitable that some of them survive and grow back to give rise to life-threatening complications. Fortunately, it is becoming increasingly clear why a few cancer cells manage to survive powerful anti-hormone therapy. This is due to the fact that prostate cells may contain small sub-populations of specialized cells, some of which are protected against changes in the hormonal environment. The section has been successful in developing a model system which measures the number of such cells and thus for the first time affording an opportunity to study the impact of various types of therapy on the lethal component of the tumour.

Advanced Therapeutics Department

SENIOR STAFF

H.K.B. Silver, BSc, MD, PhD, FRCPC, FACP
Head
Clinical Professor (Medicine)

J.H. Goldie, MD, FRCPC
Clinical Professor (Medicine)

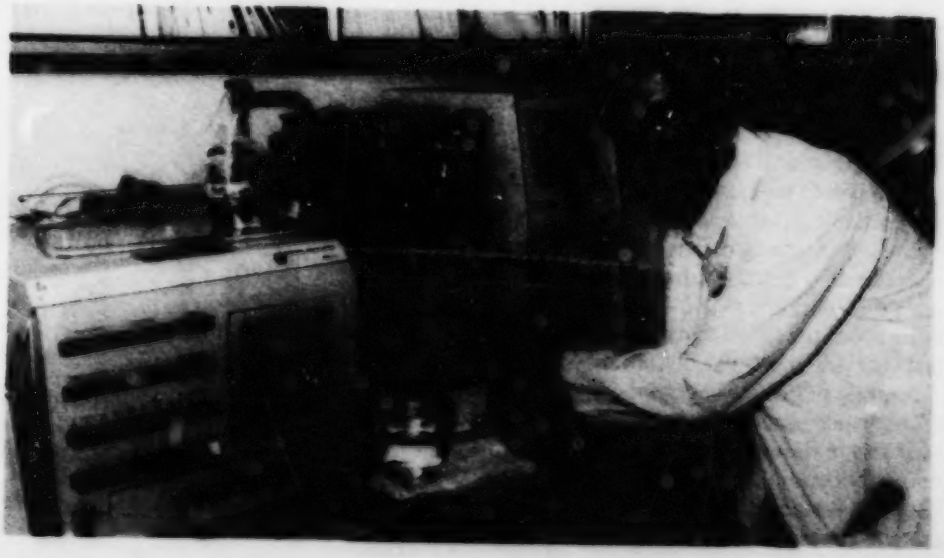
F.A. Salinas, BSc, DVM
Clinical Professor (Pathology)

S.R. Dedhar, BSc, MSc, PhD
Assistant Professor (Pathology)

R.J. Klasa, MDCM, FRCPC
Assistant Clinical Professor (Medicine)

L. Embree, BSc (Pharm.), MSc, PhD

The Section of Advanced Therapeutics continues with an array of programs with basic research components directed toward improvement in patient management. As an example, a new program has been set up under Dr. Goldie to examine laboratory and clinical aspects of Phase I chemotherapy agents. This will be with the guidance of Dr. Gelmon for the clinical aspects and Drs. Embree and Salinas for the laboratory problems. Studies under way are looking at the therapeutic advantage of liposome encapsulation of chemotherapy agents. Doxorubicin is the first agent to be studied. Preliminary information from animal studies indicate this important agent may have reduced cardiotoxicity when delivered in liposomes. Another study is seeking to determine if liposome encapsulation of vincristine will reduce neurotoxicity. Liposomes may also prove an important vehicle for biological agents. Drs. Silver and Klasa have been using animal models to evaluate liposome encapsulated interleukin-2 (IL-2). Our early studies have shown that liposomes tend to accumulate in immune active organs, such as lymph nodes and spleen, where IL-2 can best exert in effect. Animal tumor model experiments are in progress. These studies are part of a larger biological agents program. A current clinical study is evaluating the combination of interferon and IL-2 delivered to the spleen through the splenic artery. Our previous studies have shown that with this route patients experience a clear reduction in systemic toxicity, but remarkable stimulation of lymphokine activated killer (LAK) cells. LAK cells may be an important natural defense against malignancy. Drs. Klasa and Dedhar have been examining the role of integrin receptors in the function of LAK cells. It appears that integrins play an important role in directing LAK function. As such, these findings open the door to techniques for producing more active LAK cells. This work is only part of Dr. Dedhar's continuing work on the importance of integrins in malignant cell behaviour, invasion, and metastasis. Dr. Goldie has ongoing studies looking at tumor cell resistance and novel folic acid antagonist chemotherapy agents. A better understanding of the mechanisms of resistance is the first step in developing better agents. Dr. Goldie's computer model of drug resistance has already provided essential guidelines for cancer chemotherapy. As an outgrowth of this work a computer-based artificial intelligence approach to treatment is evolving. The tumor marker laboratory provides a clinical diagnostic and monitoring service for the entire province. Evolving techniques have permitted the employment of more reliable and specific marker assays. During the past year several potential markers have been examined by a novel method of analysis and, as a result, a new tumor marker will be made available for our patients.



Dr. K. A. Karim of the Advanced Therapeutics Unit is operating high performance liquid chromatography equipment for measuring drug levels in patients receiving chemotherapy.

Epidemiology, Biometry and Occupational Oncology

SENIOR STAFF

P.R. Band, BA, MD, FRCPC
Head
Honorary Professor (Medicine), Clinical Professor (Health Care & Epi)

T.G. Hislop, BSc, MSc, MD, CM
Clinical Assistant Professor (Health Care & Epi)

A.J. Coldman, BSc, MA, Dip.Ep., PhD.
Adjunct Professor (Statistics), Associate Member (Health Care & Epi)

R.P. Gallagher, BSc, MA
Clinical Assistant Professor (Health Care & Epi), Associate Member (Ophthalmology)

J.J. Spinelli, BSc, MSc
Honorary Lecturer (Health Care & Epi)

M.L. McBride, BA, MSc
Honorary Lecturer (Health Care & Epi)

W.J. Threlfall, BSc, MSc

V.T.Y. Ng, BSc, M.Math

L. Kan, BSc, MSc

The Division of Epidemiology, Biometry and Occupational Oncology was established in 1976 as a division of the B.C. Cancer Agency. Over the years the extent and scope have expanded substantially since early days, and the Division now provides a comprehensive statistical and epidemiologic consulting service for the Agency, as well as major research programs in a number of important areas. In addition, the Division provides statistical and epidemiologic support for the Screening Mammography Program of British Columbia.

The Division is divided into three groups – roughly along activity based lines – epidemiology, biometry and occupational oncology.

The section of epidemiology has research programs addressing issues in melanoma and skin cancer, breast cancer and benign breast disease.

Childhood cancers are also an important research target. Leukemia is the most common childhood malignancy in the province, and its etiology is not well understood. Epidemiologists in the section are beginning a multi-province case-control study of leukemia in order to examine whether there is an association between exposure to electrical and magnetic fields, and subsequent risk of the disease in children. A number of other possible risk factors will also be investigated.

The occupational epidemiology program has been designed with the goal of identifying carcinogens in the workplace, using a stepwise methodic approach. Two broad-based hypothesis generating studies have been completed using death registration data. These have resulted in two recent major publications, "Occupational Mortality in BC, 1950-1984" published by the Workers' Compensation Board last year, and the "Atlas of Cancer Mortality in British Columbia, 1956-1983" published by Statistics Canada.

Two major cohort studies have been completed within the past year; a retrospective study of Alcan aluminum workers, and a cohort study of airline pilots, both of which produced new and valuable findings. A further study of cancer among commercial pilots is now underway.

The Biometry Section provides biostatistical and computer expertise within the research centre and cancer agency. The group's major interest lies in the application of statistical and computer techniques to the analysis of clinical and epidemiologic problems.

The last year has seen a considerable increase in the demand for statistical services and the section has been responding to this by the development of software for the solution of problems in the analysis of clinical data. A project to investigate the computer aided diagnosis of malignant melanoma has recently begun. A particular focus of this research will be the differentiation of precursor lesions, such as dysplastic nevi, from malignant melanomas as this is a difficult clinical problem. Research also continues in the area of resistance to chemotherapy and the integration of this into the dose-intensity concept.

The Division provides the epidemiological and statistical support for the Screening Mammography Program of British Columbia. Evaluation of the program has provided a basis for further program development. The cancer detection rates for prevalent and incident cancer has increased from 4.8 and 0.8 per 1000 women screened respectively in the first year to 5.4 and 1.1 respectively in the second year. Studies of compliance to screening are being developed which will assist in the expansion of the program.

Shirley Morton inputs data for the study of cancer patterns in Canadian airline pilots.

Joint Animal Facility

The Joint Animal Facility, in 1989/90, has seen an expansion of its programs and protocols. Because of some researchers' needs for specially bred mice, the J.A.F. Management Committee approved the establishment of a separate, sterile breeding facility at the B.C. Cancer Research Centre. The Protocols for the maintenance and breeding of this colony are stringent and closely monitored by the J.A.F. Management Committee and the users themselves. The guidelines of the Canadian Council on Animal Care are closely followed.

The J.A.F. Management Committee has complied with all recommendations made by the Canadian Council on Animal Care, including increased membership, clarification of reporting relationships and a review of the Terms of Reference.

The acknowledgment of Mr. Fred Jensen's (senior technician) every day activities is noted. He has been well supported by Ms. Charlene Vikse and Ms. Pam Nevett.

The J.A.F. Management Committee reports to the Research Management committee of the B.C. Cancer Research Centre. The members of the Joint Animal Facility Management Committee during this period were: Drs. D.J. Chaplin, A. Eisen, P.W. Gout, J. Love, F.A. Salinas and J. Vielkind.

F.A. Salinas, DVM
Chairman

Master Publications List 1989-90

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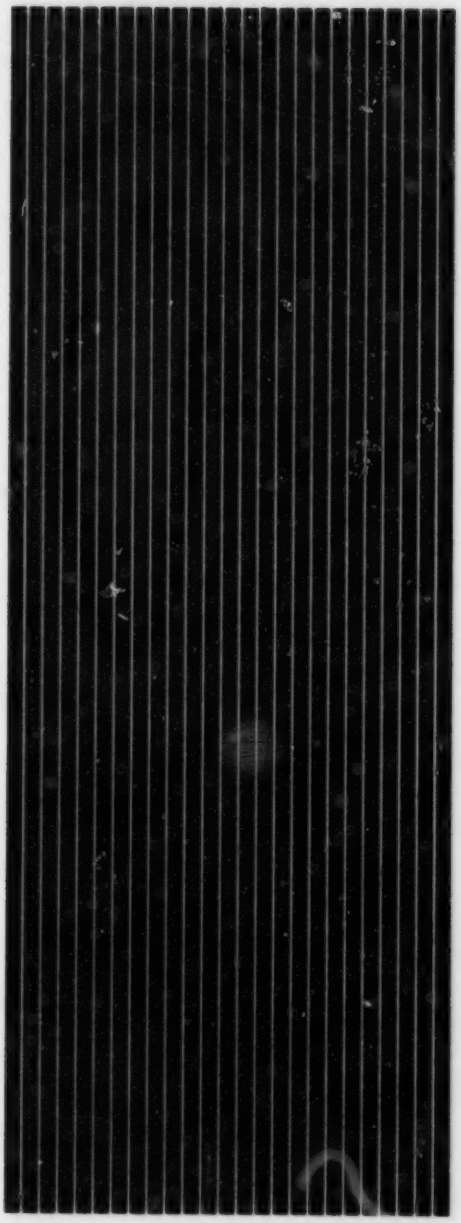

British
Columbia
Cancer
Foundation

British Columbia Cancer Foundation

The British Columbia Cancer Foundation is a society incorporated under the "Societies Act" of British Columbia and is registered as a charitable organization under the provisions of the "Income Tax Act" of Canada.

The Foundation which owns and operates the British Columbia Cancer Research Centre, as at August, 1984, also became the Foundation for the B.C. Cancer Agency, which operates cancer clinics throughout British Columbia. As such, the British Columbia Cancer Foundation is responsible for raising the supplementary funding needed by the B.C. Cancer Agency for items such as capital equipment not covered by provincial government grants.

The Foundation is totally dependent upon the generosity of the citizens of British Columbia to meet its cancer research and treatment commitments. You can support the work of the British Columbia Cancer Foundation by making a private or 'in memoriam' donation or by the making the Foundation a beneficiary in your will. Donations are deductible for income tax purposes and may be made directly to:

British Columbia Cancer Foundation
601 West 10th Avenue
Vancouver, B.C.
V5Z 1L3
Tel: 877-6010
The Foundation accepts both *MasterCard* and *VISA*.

All donations to the B.C. Cancer Foundation remain in B.C. to be used in the development of research, diagnosis and treatment which will be of direct benefit to cancer patients in the province.

A receipt will be issued, including the prescribed information, for purposes of the "Income Tax Act".

The British Columbia Cancer Foundation is most grateful to those whose generosity helps in the ongoing fight against cancer.

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President's Report

Your Honorary Treasurer has reported in detail on the results of the operations of the Foundation. While our loss was considerably below our original budget forecast, this result was essentially achieved by the curtailment of expenditures, most of which will have to be met in the 1990/91 fiscal year.

The continuing demands for additional personnel, equipment and space in the Research Centre are now a literal fact of life as the scientists and technicians refine their discoveries or thrust into new areas of concern and applications of these results.

The continuing escalation in the average age of our population and the resultant relative increase in cancer, earlier diagnosis and progessive treatment techniques brings further pressures. Our Research Centre is out of space and expensive to maintain and consequently new facilities must be planned for the near future.

In view of all this we are most fortunate in British Columbia to have some of the nation's leading treatment centres in the B.C. Cancer Agency's Vancouver and Victoria Clinics. The provincial government has also announced that further clinics will be built for the Agency in the near future at outlying locations, making patient treatment much more accessible. We are proud and pleased to be associated with the Agency, both in the treatment clinics and the Research Centre and to act as their Foundation for fund raising.

In British Columbia we have a Research Centre whose scientists and their efforts are well recognized on an international basis. Monetary support to the Research Centre from a variety of national and international institutes and foundations, the attraction of internationally distinguished scientists and the myriad requests for our scientists and medical professionals to appear before national and international symposia attest to this stature.

The rapid changes occuring in cancer research and treatment continually accelerate the need for funds for additional scientists and support staff, equipment and facilities. We have, over the last few years, initiated a number of direct activities to improve our financial position, a series of public approaches through direct mail appeal, lotteries, advertising, United Way, and provincial government negotiations. These approaches are gradually, but surely, providing tangible results.

We are engaged with the B.C. Cancer Agency in a $5.5 million Capital Fund Campaign to provide equipment and structural modifications for the Agency and the Research Centre that are not covered through government grants. We thank the Honorary Chairman, Gordon MacFarlane, Barbara Brink who is chairing this campaign and the volunteer members of the Campaign's excellent Steering Committee.

We have had several months of in-depth discussions and numerous drafts of a memorandum of understanding with the British Columbia & Yukon Division of the Canadian Cancer Society in anticipation of establishing one fund raiser for the cancer cause in the province. I would be remiss if I did not take this opportunity to thank the volunteer members of our Executive Committee, Stuart Lang and Barrie Philp, Dr. David Klaassen, Director of the B.C. Cancer Agency and Deputy Director, Brian Schmidt, all of whom have spent literally hundreds of hours in these negotiations.

Throughout the Foundation's long history women have given outstanding service in supporting the cause. Again this year we must extend our thanks and pay tribute to the wonderful work of the Women's Auxiliary to the B.C.C.A. and the Foundation, the Order of the Eastern Star, the I.O.D.E. and the Women's Auxiliary to the Fraternal Order of Eagles.

Succinctly, the incidence of cancer, in B.C. as elsewhere, is on the rise but the lives of those inflicted and those with potential to become inflicted in British Columbia are enhanced by the research, diagnosis and treatment available here. The fight, however, is never-ending. In the words of Churchill, which have been adopted as the slogan for the Capital Fund Canpaign - "Give us the tools!" The benefits of our efforts to date must be credited to the commitment and support of the patients, to our scientists and doctors, to our Executive Director, David Catton, the administrative support and direct participation of the B.C. Cancer Agency under the direction of Dr. David Klaassen and Brian Schmidt, our Executive and Board and our increasingly generous and supportive friends.

Ian M. Adam,
President

Women's Auxiliary

The Women's Auxiliary to the British Columbia Cancer Foundation and the Canadian Cancer Society, B.C. and Yukon Division, and the Vancouver Clinic is now in its forty-fourth year of service.

Because we are not a fundraising organization we are grateful for the financial support given us by the Society and the Foundation. The greater part of our funds are used for patient comfort. For the sewing department, we purchase material to make head caps for chemotherapy patients, stoma bibs for tracheostomy patients and special binders for patients leaving the operating room. At Christmas we distribute baskets filled with home baking, fruit, candies and knitted goods for hospital patients and those staying at the Lodge. In the magazine department most magazines are donated but we do subscribe to a few to enable us to supply the waiting rooms and examining rooms with current reading material.

Throughout the year our members concentrate their energies in various activities. Escorts meet and accompany first-time patients to the various stations and aides assist in ambulation to various departments within the care clinics. The cart ladies make regular rounds with the "candy wagon" and also with reading material.

The patient aides serve coffee, tea and juices in the Radiation Therapy Department. Two ladies keep magazines circulated and updated weekly. The sewing department is always busy with the increasing demand for head wear and stoma bibs.

Our volunteers continue to provide support at the TRIUMF treatment facility. Our volunteers also continue to put in extra hours in response from the Social Work Department visiting patients on the fifth and sixth floors when patients from out of town have no one to support them during their stay in the hospital.

At the Christmas season we have the pleasure of decorating the clinic and distributing poinsettias to various departments.

At our annual meeting last April in the absence of our Honorary Patroness Mrs. David Lam, Bonnie Jamieson, Assistant Deputy Director, presented the long service pins: one for 25 years, one for 20 years and one for 15 years.

As representative of the Auxiliary it has been my privilege to serve on the Board of Directors of the Cancer Society and the Foundation, and to attend, as an observer, the meetings of the Board of Trustees of the British Columbia Cancer Agency. I found it most interesting as it has given me an insight into the problems and goals of these organizations.

On behalf of the Women's Auxiliary, I would like to thank the B.C. Cancer Foundation and the British Columbia Cancer Agency for their continued interest and support.

Kathleen Conway
President

Student Research Awards

PETER CHOI

Peter Choi, the 1990 A. Maxwell Evans Award recipient, is a first year medical student at the University of British Columbia where he has attained an overall average of 81%. Peter entered the honours genetics program at UBC and, from all accounts, intended to focus his studies on colour-blindness. However, after taking an oncogenetics course as an elective, he spent his fourth year studying the mysteries of DNA repair using repair-defective mutants of the common fruitfly. This summer, Peter is working with Dr. Heather Sutherland in the Terry Fox Laboratory on a study of the functional characterization of the human hemopoietic stem cell.

TORSTEN NIELSEN

Torsten Neilsen is a fourth year honours biochemistry student on scholarship at the University of British Columbia. Although he has won awards in basic chemistry, physics, mathematics, and computer science, it is to a future in cancer research that he is attracted both as a career and as a challenge. Active in the environmental movement, he is interested in cycling, hiking, and tennis, while his favourite non-science subjects are ethics and creative writing.

Report of the Building Committee

It has been an exceedingly busy year for the Property and Building Committee. I returned as protem Chairman when the new Chairman, John McKay, resigned because of the pressure of new professional assignments. It was unfortunate that he had to leave us after only a short time in the Chair, but we thank him for his efforts on our behalf.

The major project completed in the year under review was the new Level III Gene Transfer Laboratory, part of the Terry Fox complex on the second floor of the Research Centre. Also on that floor, work commenced on the Biophit (recreational) area to adapt it for use as a training facility for Ph.D. students in the Terry Fox lab.

Because of the age of the building, mechanical plant and equipment is under constant review. For example, in the current year the boilers were relined and the major electrical installations - transformers, switchgear and standby generator - were all inspected, cleaned and put into good working order.

During the year, the Committee learned that the roof of the Research Centre is in constant need of repair. For example, in July we were advised that 13 holes had been patched and by October this number had risen to thirty. Obviously, a major assessment of the roof was required and our Committee called for a professional site inspection.

In August the Committee was advised that there had never been an inspection contract for the freight elevators. Consequently, the Foundation faced a serious legal liability in case of an accident. A service contract was immediately recommended to the Executive Committee and put in place without delay.

Once again, the inadequacy of the old building to cope with emergent technical requirements was underlined in the case of the Medical Biophysics Unit. A new Atomic Absorption Spectrometer was acquired by grant funding. It called for some simple venting, but because it was in an area of the building where ducting was not already available, it required the installation of still another venting system through the roof.

This review can only cover a small fraction of the items dealt with by the Committee in the past year, but these few examples serve to provide an overview of the type of continuing problem with which the Committee is faced in its ongoing stewardship of the Research Centre Building on behalf of the B.C. Cancer Foundation which owns and operates the building.

Throughout the year, the Committee continued to study and assess space requirements for the various research units. There seems always to be a demand for additional space and while some of the needs, such as the Level III Laboratory, are met by special funding initiatives, the majority are held in abeyance because of the Foundation's financial position. We are sure this situation is even more frustrating to our scientists than it is to the members of my Committee. We are hopeful that some of the problems will be alleviated by funds flowing from the B.C. Cancer Agency's Capital Fund campaign. Meanwhile, until an answer can be found to the funding question, further expansion is on hold. I would also urge that there needs to be immediate and continuing recognition that considerable funding will be required for regular maintenance, unforeseen repairs, and longer term maintenance projects.

Through the years, the Property and Building Committee has expressed concern about space utilization. Over time, expansion has been on an ad hoc basis and the Committee has no very clear understanding of either the over-utilization or under-utilization of space. At some time in the future, we will probably be recommending a professional space utilization study to provide hard information for purposes of analysis and planning.

I wish to offer a special word of thanks to our Consulting Architect and an ex officio member of our Committee, Mr. Einar Labo, for his excellent guidance and counsel. At all times, he provides the utmost assistance and cooperation and his technical knowledge and expertise have provided great support for the Committee. Also of note has been the outstanding work of the Plant Operations and Maintenance Division of the B.C. Cancer Agency. Supervised by Mr. Stan Young and his able associate, Mr Bill Arborak, the Division has gone out of its way to hold the line on costs and has continually undertaken jobs "in-house" which would have cost the Foundation many thousands of dollars if we had been required to hire technical staff outside. We thank them for their concern and their effort which resulted in a major reduction in the Foundation's anticipated deficit in the year under review.

Finally, I wish to thank the members of my Committee for their dedication and service to a very important cause. I believe I can say with confidence that, while we have been able to accomplish relatively few of the major tasks confronting us, on the whole we have a better grasp of the problems of the Research Centre and the old building is in somewhat better shape than it was when we entered the year.

Respectfully submitted,
Phillip A. Heaps,
Chairman

Bursary, Scholarship & Awards Committee

The Bursary, Scholarship & Awards Committee met in February to review a total of 25 studentship applications for the May - August term. As in the past, awards were granted on the basis of each student's qualifications as well as the quality and relevance of the proposed project in the field of oncology.

I am pleased to report that a total of 14 studentship awards were granted, including the J.M. Warren and A. Maxwell Evans Awards. We were also awarded a grant from the Challenge '90 Program which was used to partially fund 2 of the studentships.

The Studentship recipients for 1990 are: Jan Jaap Bijlsma, Michael Butchart, Carolyn Fekete, Cigdem Guzzo, Jeremy Jackson, Darren Jakubec, Vivienne Jones, Seema Khangura, Rick Little, Dana Miskulin, Robin Parker and Robert Taylor.

Every year, the A. Maxwell Evans and the J.M. Warren Awards are granted to two outstanding students. This year, Mr. Peter Choi was awarded the A. Maxwell Evans Award, on the advice of the Faculty of Medicine, University of British Columbia. Mr. Choi is working with Dr. Heather Sutherland of the Terry Fox Laboratory on a project entitled "Functional Characterization of the Human Hemopoietic Stem Cell".

The J.M. Warren award was granted to Mr. Torsten Nielsen, the highest ranking studentship applicant. Mr. Nielsen is working with Dr. Dixie Mager of the Terry Fox Laboratory on a project entitled "Molecular Markers for Genetic Rearrangements in Leukemic Cells".

All students will be working under the supervision of senior scientists who are affiliated with the B.C. Cancer Research Centre, the University of British Columbia or the University of Victoria.

We are grateful once again to the Canadian Cancer Society for providing the major funding for twelve of the B.C. Cancer Studentships. We appreciate the Society's continuing support and generous contribution to this very important program. Funding for both the A. Maxwell Evans Award and the J.M. Warren Award is provided annually by the B.C. Cancer Foundation from the proceeds of an Endowment Fund established in 1984.

During 1989-90, the British Columbia Cancer Foundation approved 21 travel grants to graduate students and post-doctoral fellows. These grants were established to help defray travel costs when students are invited to attend conferences to present their work in the field of cancer research.

Both the studentship program and the travel grants are important to the British Columbia Cancer Research Centre. These prestigious awards enable us to recognize academic excellence and to encourage promising young people to continue to pursue a career in oncology.

In recent years, all funding for the Studentship program has been awarded for the summer term, thereby allowing up to 14 excellent candidates a chance to work in cancer research for the May - August term. As a result, there has been little or no funding available for the balance of the school year. In order to reduce confusion, the BSA Committee has therefore decided that the B.C. Cancer Studentship program should be made available only for the May - August term.

I would like to thank the members of the Committee for their guidance and assistance in making this educational program a success: Dr. N. Auersperg, Dr. G. Ballantyne, Dr. D. Mager, Dr. B. Palcic, Mrs. A. Pattie, Dr. P. Rennie, Dr. H. Stich, Mr. I.M. Adam, and Mr. D. Catton.

Anna Linsley
Chairman

Finance Committee Annual Report

Total fund balances at fiscal year's end were about the same as the previous year's. However, this break-even position can be attributed to an increase in Designated funds. This points up the continuing difficulty in meeting ever-increasing operating costs which have to be met from General funds.

For example, the change in the General Fund balance for the year reflects a deficit of $347,847.00 This can only be met by a further erosion of the Foundation's capital account. The deficit was somewhat lower than had been forecast, implying a careful handling of expense items throughout the year.

Part of the problem lies in the nature of public giving. It is obviously impossible to predict whether the public's generosity will be directed to designated or undesignated gifts. To offset this problem, the Foundation has initiated an active program of fund raising which is designed to ensure that the General Fund will not be in a deficit position.

The area of expense control is being continuously monitored. We are working to avoid any curtailment of research activities and we must "meet the market" in terms of wage requirements. Also, maintenance and repair of our aging building calls for a constant state of vigilance. In the past year, for example, we have become aware of the need to replace the roof. This is a major and unexpected expense item. And there could be further unanticipated costs related to problems in the exterior walls of the building once the roof is removed. At this time there is no provision in the Foundation's budget which would permit us to deal with such maintenance problems.

At the moment, the Foundation's budgetary outlook for the coming year is not encouraging. Careful and realistic planning still results in a predicted $295,000.00 deficit. There are certain (and as yet unfinalized) funding initiatives underway which could change this prediction markedly.

A great deal of thought has been given this past year to the Foundation's difficult fiscal matters. On behalf of the Finance Committee, Mr. I. Adam, Mr. V. MacLean and Mrs. A. Linsley, I thank for their support Ms. B. Prieur, Ms. S. Kennedy, Mr. D. Catton, Mr. D. Morrison and our auditors, Price Waterhouse.

Fred B. Moore
Chairman
Finance Committee

Auditors' Report

May 18, 1990

To the Board of Directors,
British Columbia Cancer Foundation

We have examined the balance sheets of the general and designated funds and the British Columbia Cancer Research Centre fund of the British Columbia Cancer Foundation as at March 31, 1990 and the statement of changes in the general and designated fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as we considered necessary in the circumstances

In our opinion, these financial statements present fairly the financial position of the Foundation as at March 31, 1990 and the results of its operations and changes in financial position for the year then ended in accordance with accounting principles described in Note 2 on a basis consistent with that of the preceding year.

Price Waterhouse
Chartered Accountants

Balance Sheet
General and Designated Funds

	March 31 1990	1989
Assets		
Current assets:		
Cash and short-term investments (Note 3)	**$3,806,869**	$3,170,268
Amounts receivable	**263,380**	214,913
Prepaid expenses	**55,029**	144,382
Inventory	**32,405**	65,615
	4,157,683	3,595,178
Other investments, at cost which approximates market value (1989 at cost, market value – $1,572,626)	**1,507,164**	1,722,156
British Columbia Cancer Foundation Endowment Fund (Note 4)	**734,000**	734,000
	$6,398,847	$6,051,334
Liabilities and Fund Balances		
Current liabilities:		
Due to British Columbia Cancer Agency	**$ 313,147**	$ 279,019
Accounts payable and accrued liabilities	**67,156**	91,348
Deferred revenue	**48,333**	51,410
	428,636	421,777
Fund balances:		
General	**674,999**	1,022,840
Designated	**5,295,212**	4,606,717
	5,970,211	5,629,557
	$6,398,847	$6,051,334

APPROVED ON BEHALF OF THE BOARD:

_____ Director _____ Director

Balance Sheet
British Columbia Cancer Research Centre Fund

	March 31 1990	1989
Assets		
Land, buildings and improvements, at cost (Note 5)	**$4,190,552**	$4,190,552
Fund Balance		
Fund balance	**$4,190,552**	$4,190,552

Statement of Changes in General and Designated Fund Balances

	Year ended March 31, 1990			Year ended March 31, 1989		
	General Fund	Designated Fund	Total	General Fund	Designated Fund	Total
Fund balances at beginning of year	**$1,022,840**	**$4,606,717**	**$5,629,557**	$ 631,290	$1,928,634	$2,559,924
Additions:						
Revenue –						
Bequests	**533,211**	**320,502**	**853,713**	1,021,223	2,781,680	3,802,903
Donations	**365,955**	**938,621**	**1,304,576**	300,330	229,072	529,402
Investment income	**287,069**	**510,087**	**797,156**	247,338	179,950	427,288
Fees from services	**–**	**559,415**	**559,415**	–	388,172	388,172
Canadian Cancer Society	**50,000**	**–**	**50,000**	164,000	–	164,000
Fund Raising Projects – net of direct expenses	**216,153**	**–**	**216,153**	173,349	–	173,349
Other	**68,655**	**144,317**	**212,972**	44,722	111,556	156,278
	1,521,043	**2,472,942**	**3,993,985**	1,950,962	3,690,430	5,641,392
Deductions:						
Research expense						
Core Support Units						
Cancer Imaging Unit	**200,446**	**–**	**200,446**	194,890	–	194,890
Environmental Carcinogenesis Unit	**192,605**	**–**	**192,605**	156,058	–	156,058
Medical Biophysics Unit	**466,442**	**10,379**	**476,821**	389,002	–	389,002
B.C. Cancer Research Centre – net of recoveries	**518,692**	**–**	**518,692**	548,359	–	548,359
Laboratory and other services	**–**	**477,240**	**477,240**	–	384,109	384,109
British Columbia Cancer Agency	**7,892**	**1,084,690**	**1,092,582**	5,604	517,646	523,250
Designated projects	**–**	**212,138**	**212,138**	–	110,592	110,592
Unallocated administration (Note 6)	**198,917**	**–**	**198,917**	192,671	–	192,671
Writedown of investments	**214,992**	**–**	**214,992**	–	–	–
Other	**68,898**	**–**	**68,898**	72,828	–	72,828
	1,868,884	**1,784,447**	**3,653,331**	1,559,412	1,012,347	2,571,759
Change in fund balances	**(347,841)**	**688,495**	**340,654**	391,550	2,678,083	3,069,633
Fund balances at end of year	**$ 674,999**	**$5,295,212**	**$5,970,211**	$1,022,840	$4,606,717	$5,629,557

Notes To Financial Statements

March 31, 1990

1. Nature of operations:

The British Columbia Cancer Foundation (the Foundation) funds and operates the British Columbia Cancer Research Centre facility (the Research Centre).

The Foundation allocates its revenues and expenditures as follows:

Operating funds –

General Fund –

This fund receives all revenues which are not specified or designated at source as to their use. The Executive of the Foundation from time-to-time commits certain of these revenues to specific projects of the British Columbia Cancer Research Centre Fund and the British Columbia Cancer Agency (formerly the Cancer Control Agency of British Columbia).

Designated Fund –

This fund includes bequests, donations and investment income which are designated for a specific use by the donor.

British Columbia Cancer Research Centre Fund –

This fund represents the cost of the Foundation's investment in the land, buildings and improvements of the Research Centre.

2. Accounting policies

The Foundation's accounting policies follow generally accepted accounting principles except that income from bequests and donations is recorded when received.

Land, buildings, and improvements held for research purposes are capitalized in the British Columbia Cancer Research Centre Fund at cost and no depreciation is charged.

3. Cash

The Foundation has invested $1,586,000 (1989 – $1,105,000) in an interest bearing account administered by the British Columbia Cancer Agency.

4. British Columbia Cancer Foundation Endowment Fund

The Fund is administered by the Vancouver Foundation with the Foundation receiving the income generated therefrom after deduction of administrative costs. Under the terms of the agreement, the Foundation will be entitled to withdraw all of its contributions after December 31, 1990 with the exception of $10,000 initially contributed which was expensed 1981. The capital in the Fund amounted to $1,159,000 at March 31, 1990 (1989 – $1,159,000) of which $744,000 was contributed by the Foundation and $415,000 by the Vancouver Foundation.

5. Fixed assets

No fixed assets were capitalized in 1990.

During 1989 $34,864 of fixed assets were capitalized, of which $9,984 was reimbursed by the British Columbia Cancer Agency. The Foundation's portion ($24,880) was expensed in the General Fund.

6. Unallocated administration expense

	1990	1989
Salaries and benefits	**$ 48,865**	$ 32,655
Office and general	**46,299**	60,945
Legal and audit fees	**18,548**	21,082
Fund-raising and development	**85,205**	77,989
	$198,917	$192,671

7. Investigative grants fund

The Foundation acts as custodian for investigative grants awarded from various private and public agencies for specific research projects. Amounts administered by the Foundation are as follows:

	1990	1989
Amounts receivable, beginning of year	**$ (82,516)**	$ (208,099)
Add: Advances on grant awards	**1,645,431**	1,471,175
	1,562,915	1,263,076
Less: Expenditures	**1,464,094**	1,345,592
Excess advances (amounts receivable) end of year	**$ 98,821**	$ (82,516)

Excess advances are not included in cash and short-term investments, while deficiency in grants received is reflected in amounts receivable at year-end.

8. Statement of changes in financial position

A statement of changes in financial position has not been presented as it is not considered meaningful in the circumstances.

Donations and Bequests

received during the period April 1, 1989 to March 31, 1990.

Abercrombie, Mr. Paul	150	Barr, Mr. L.M.	300	Brinton, Mr. Eric	100	Clark, Mr. C.	100
Adair, Miss Josephine	500	Barrett, Mrs. Anne	100	Brody, Mr. & Mrs. H.S.	100	Clark, Ms. Joan	100
Adam, Mr. Ian	2,000	Barrett, Mr. Brian	100	Broomfield, Mr. G.A.	1,000	Clark, Mr. Wayne T.	100
Adams, Mr. David A.	200	Bartram, Mr. Robert	100	Broughton, Sandra S.	100	Clarke, Miss Doreen	500
Adams, Mrs. Nettie	100	Bayley, Anna F.	200	Brown, Dorothy	200	Clarke, Mr. Denis C.	100
Adamson, Mr. Donald	200	Beattie, Mrs. Gillian	100	Brown, Quentin	100	Clarke, Ms. Doreen J.	600
Agabob, Miss Nora	200	Beaumont, Ms. Donna	110	Brown, Jean G.	500	Clarke, Mr. Douglas H.	100
Akrigg, Mr. Cecil N.	1,073	Beckmann, Mrs. Elizabeth	100	Brown, Ms. Carol	100	Clay, Mrs. Edith	100
Albinson, J.C. & K.J.	100	Begg, Mrs. Eleanore	100	Brown, Miss May	100	Cliff, Mrs. Nancy	2,000
Alexander, Dean & Joy	400	Beirnes, Mrs. Virginia	200	Brown, Mr. Colin	100	Cliff, Mr. Ronald Laird	2,000
Alexander, Mrs. Diane	100	Belfry, Mr. W. Roy	100	Brown, Ms. Joanne L.	1000	Cliff, Mrs. Ardelle	100
Alexandor, Ms. Virginia	100	Belkin, Helen E.	1,100	Brown, Ms. Judi	100	Cliff, Ms. Leslie G.	3,000
Allan, Miss Janet	100	Bell, Dr. Roy D.	550	Brown, Mrs. D.	100	Cliff, Mrs. A.B.	100
Allan, Mr. & Mrs. A.	200	Bell, Mr. Harry	100	Brown, Mr. W. Dewiss	100	Clinton, Mrs. Sally	200
Allan, Mrs. Jean	100	Bell-Irving, Miss Joan	200	Brown, K.D.	100	Clyne, Mrs. Margaret E.	100
Allen, Mrs. Rosemary J.	100	Bell-Irving, Mr. Theo	100	Brown, Ms. Janet L.	100	Coenen, Mrs. Rosario	100
Allen, Mr. J.	100	Bell-Irving, Mr. H.P.	100	Bruk, Mr. John	2,000	Coffman, Mrs. Iris	500
Allen Rae, Mr. B.	250	Bennett, Mrs. Adele	1,000	Bruneski, Mrs. Flora	100	Coggin, Ms. Mary	2,000
Allison, Mrs. Mona	100	Bennett, Ms. Mary M.	100	Bryson, Mary	100	Colborne, Isabelle	4,666
Allison, Ms. Gwen	200	Bennett, Mr. Winslow W.	1,667	Budd, Sandra H.K.	100	Colborne, Mr. & Mrs. Rick	528
Amos, Mrs. S.T.	100	Bentall, H. Clark	150	Bull, Mr. John	500	Coles, Mrs. Anna M.	100
Amos, Ms. Shirley	550	Bentley, Ms. Antoinette	200	Bunnell, Mr. & Mrs. R.	100	Coles, Mr. J.A.	300
Anderson, Edward C.	100	Berck, Mrs. Brenda	100	Bunting, Mr. & Mrs.	100	Colquhoun, Joe & Glenda	100
Anderson, Miss Joan	100	Bergen, Calvin H.	1,000	Burke, Mrs. Margo	100	Conder, Mr. John	100
Anderson, Miss Elizabeth	100	Bergman, Mr. Anders	100	Cameron, Olga	1,000	Connelly, Mr. Ronald	100
Anderson, Dr. R.G.	100	Bernard, Mr. Paul A.	200	Campbell, Ms. Evelyn	100	Connolly, Mr. Patrick	500
Anderson, Mr. Robert	150	Berry, Mrs. Lucy M.	250	Campbell, Ms. G.	100	Conway, Mrs. Kathleen M.	349
Andras, Mrs. Frances	100	Bessner, Mr. Leonard	5,000	Campbell, Mr. Gordon D.	100	Cooper, Mrs. Olive	100
Andrews, Ms. Barbara M.	100	Bhadlawala, Mr. Parin	100	Campbell, Mr. & Mrs Wm.	100	Cooper, Mrs. B.	100
Angus, Mrs. Ann C.	500	Bhadlawala, Pann	100	Cantelon, Mrs. Norma Jane	100	Cornwall, Mr. & Mrs. G.L.	100
Angus, Ms. Mary	100	Bifolchi, Mrs. Loreen	100	Carey, Ms. Nancy	100	Corrales, Ms. Edna	100
Anonymous	1,534	Bingham, Mrs. Janet	100	Carlson, Mrs. Stephanie	600	Coumont, Mr. Ronald R.	100
Anonymous	200	Bings, Mrs. Miriam	200	Carnsew, Mrs. Polly	100	Courtemanche, Mrs. A.D.	100
Anonymous	290	Birks, Mrs. Audrie M.	100	Carroll, Mrs. Ann	100	Couvelier, Honourable Mel	100
Archer, Ms. Betty	150	Birnie-Danzker,		Carson, Mr. Gordon	100	Cowling, Helen M.	100
Archer, Rev. & Mrs. G.B.	200	Ms. Jo-Anne	100	Carter, Mrs. M.E.	100	Craig, Mrs. Claudia J.	100
Armstrong, Mrs. Barbara G.	100	Black, G.M.	100	Cassady, Ms. Marilyn	100	Creagh, Mrs. Leta	200
Armstrong, Mrs. Jean S.	100	Black, Mrs. Georgia	100	Caswell, Ms. E.M.	100	Creigh, Miss Helen	200
Armstrong, Mr. W.E.	300	Blagborne, Mrs. Ilene	100	Catton, David	200	Cronin, Mr. & Mrs. John	100
Arnold, Mr. Ross	100	Blaylock, Mr. J.C.	100	Catton, Mrs. Jean	200	Crosby, Ms. Ellan	100
Arter, Mrs. Edna T.	100	Blaze, Ms. Mary	100	Chadwick, Barrie	1,000	Crutchley,	
Arter, Mr. H.R. (Dick)	100	Blom, Mr. Jan	1,000	Chan, Mr. & Mrs. G.	500	Mr. & Mrs. George	100
Atagi, Mr. Isamu	200	Boehr, Mr. John	100	Chan, Mr. Michael Y.	100	Culter, Mrs. Linda Diane	100
Atkinson, Miss Sheila	550	Bogdan, Forwin	150	Chance, Mr. B.	100	Culwell, Mr. Michael	100
Atkinson, Mr. Paul	100	Boultbee, Mrs. Helen Ann	100	Chang, Mr. W.	100	Cumming, Mrs. Margaret I.	100
Averill, V. & L.	100	Boyce, Mrs. Barbara	100	Chen, Hua An	100	Cunningham,	
Averill, Mr. Robert	100	Boyce, Mrs. Dorothy-Jane	1,000	Cheney, Mr. Dale F.	220	Mrs. Rosemary	100
Axelson, Mrs. Mildred	3,000	Boyd, Mrs. Yvonne	100	Cherniavsky, Mr. Peter A.	1,000	Cunningham, Ms. Norma	100
Babish, Mr. Peter	100	Boyer, H. Bud	250	Chernov, Philip	150	Currie, Mr. & Mrs. James E.	100
Bacani, Mrs. Mila	250	Bradshaw, Mrs. Valerie	100	Cheung, Mr. & Mrs. J.	2,000	Cziborr, Mrs. Audrey	100
Bailey, Mr. George	100	Brager, Mr. M.	100	Chilcott, Mr. Robert	600	Dafoe, Mr. Richard	300
Bailey, Mr. & Mrs. G.H.	100	Brand, Ms. Rosalyn	500	Ching, Mrs. Denise	100	Daughney, Mrs. Judy	100
Baker, Ms. Marjorie J.	100	Brandak, George	100	Chomack, Mike	400	Davidson, Mr. A. Ian	100
Baker, Mr. J. Richd	100	Brander-Smith, Mrs. June	100	Chow, Mrs. Bernadette	100	Davies, Mrs. Maureen	100
Balsor, Mrs. Alice	100	Brass, Mrs. Alice	100	Chow, David	100	Davies, Mr. T.G.	200
Bancroft, Mr. & Mrs. G.	300	Brasso, Ms. Kathleen	100	Chow, Ms. Annie	100	Davis, Mrs. Margaret R.	100
Barker, Mrs. Julia	100	Brazier, Ms. Gail	100	Chritchley, Dr. J.H.	1,500	Dawson, Ms. Elizabeth	100
Barnett, Mr. Jeff	600	Bream, Mr. K.	100	Chrystal, Mr. Alex	500	Dawydiak, Mary	100
Baron, Mr. Don	100	Brink, Mrs. Barbara	150	Chung, Mr. Henry	1,000	De Roche, Mr. H.W.	100

Dejong, Mrs. Helena	100
Delville-Pratt, Desmond	100
Dengler, Wast	100
Denhaan, Mr. Bert	100
Dennison, Lorna	311
Denny-Lang, Mrs. Stephanie	100
Derby, Mrs. G.	100
Derosier, Mr. Allen	1,000
Derton, Miss Clara	250
Devlin, Mr. John H.	5,000
Dexter, Mr. William A.	100
Diamond, Miss Isabelle	500
Diamond, Ms. Leslie	100
Dietrich, Ms. Elizabeth	100
Dingle, Mr. H.H.	200
Diwell, Elizabeth	125
Dmytriw, Roman	100
Dmytryshyn, Mrs. Linda	100
Dobbs, Mrs. Joyce	100
Dobell, Mrs. I. Anne	100
Dobrilla, Mr. & Mrs.	100
Dobrzensky, Mrs. Aline	100
Dodd, Mrs. Lillian	100
Dodds, Ms. Frances	100
Dolman, Dr. Jennifer E.	550
Donald, Mr. Ian J.	200
Donaldson, Mrs. Elaine	100
Doran, Mrs. Jean B.	100
Dossa, Mrs. Nurbanu	100
Dossett, Mr. Edward J.	2,900
Douglas, Margaret	100
Douglas, Mrs. Suzanne A.	100
Douglas, Mr. George	200
Downey, Mrs. Joan	100
Downie, Ms. Mary	100
Draper, Ms. Reta	300
DuMoulin, Mrs. Patricia M.	100
DuMoulin, R. Theo	100
DuMoulin, Mr. Michael	225
Duffus, Ms. Mary	100
Duholke, Mr. Brad	100
Dumaresq, David J.	250
Dumoulin, Ms. Linda	100
Duncan, Norman E.	125
Dunlop, Lynne	100
Eaves, Charles	100
Eaves, Dr. Connie	105
Eddy, Mr. Darryl	200
Edmonds, Mr. William H.	100
Edwards, Ms. Frances M.	100
Edwards, Mr. Harley G.	800
Eisen, Mrs. Joyce	125
Elaway, Mr. & Mrs. R.	100
Elliott, Miss A.M.	200
Elliott, Mr. Kent	100
Ellis, Mr. Robert J.	100
Ellis, Mr. Brian A.	100
Eng Somjen, Mrs. Andrea	100
Erhardt, Dwain & Wendy	1,000
Erskine, Mrs. Audrey M.	5,000
Ervin, Ms. Cindy	100
Eugene, Mr. I.	100
Evans, C. Anne	100
Evans, Dr. Adele M.	900
Evans, Ms. Evelyn May	500
Evans, Mr. Frank	100
Everett, Mrs. Suzanne	100
Eyford, Mrs. Laura	100
Faiola, Ms. Maria G.	500
Fairbairn, John S.	100
Fallow, Mrs. Lila P.	100
Farley, Mr. D.J.	100
Farrand, Mr. & Mrs. C.	100
Fawcett, John Noble	200
Fay, Mrs. Wendy	100
Fay, Mrs. Violet Jean	500
Fedoruk, Ms. Sylvia	200
Fehr, Mr. Abraham	300
Fenn, Mrs. Colleen	100
Ferguson, Mr. William J.	100
Ferguson, Mr. John W.	100
Ferrie, Mr. W. Michael	100
Field, Mrs. Hilda	100
Fielder, J.H.	300
Findlay, Mr. W.R.	150
Fitzgibbon, Mr. Brian	100
Fitzmaurice, Mr. James	100
Fitzpatrick, Mrs. Linda	100
Fjordbotten, Mrs. Edna	100
Flagg, Rev. Dr. E.G.	100
Fleck, Miss Gloria	100
Fletcher, Mrs. Catherine N.	100
Flowers, Mrs. Barbara	100
Ford, Mrs. Marguerite	100
Ford, Mrs. Ivy	100
Ford, Ms. Janet Vosburg	1,000
Foreman, Ms. Barbara D.	100
Forsyth, William M.	200
Forsyth, Mrs. Violet	250
Fortuna, Mr. Robert	550
Forzley, Ms. Beverly G.	100
Fossett, Mr. J. Ralph	100
Fouks, Arthur	200
Francis, Mrs. Daphne M.	100
Fraser, Miss Jone	100
Fraser, Mrs. Janet	100
Fraser, Mrs. Jandi	100
Fraser, Mrs. Gladys	100
Frazer, Mrs. Margaret	100
French, T.	300
Frew, Agnes C.	100
Freybe, Ulrich & Ruth	500
Friberg, Ms. Peggy	100
Friesen, Mrs. Carol	100
Froembling, Mr. Otto	100
Frost, Mrs. Jane Elizabeth	100
Fulop, Mr. Louis	100
Fung, Mr. Andrew	100
Gaarder, Mrs. Eva	100
Galbraith, Mr. John	100
Gallagher, Ms. Eleanor	500
Galloway, E. James	200
Gannon, Robert C.	100
Gartshore, Mrs. Anne	100
Gaube, Mrs. Hannah	100
Geoghegan, Mrs. Barbara	100
George, Joan E.	100
George, Mrs. Mary	100
Gibson, Constance C.	600
Gibson, Mr. & Mrs. Gerald T.	200
Gibson, Mrs. Norah I.	100
Gibson, Ms. Kilby Ann	100
Gielty, Sarah	100
Gilani, Mr. G.H.	500
Giles, Mary	200
Giles, Mrs. Virginia	100
Gill, Mr. & Mrs. Thomas	500
Gillanders, Mrs. Barbara	100
Gillespie, Mrs. Pearl E.	100
Gillespie, Mr. Kenneth H.	100
Gilley, Mrs. H. Patricia	250
Gluskin, Mr. David J.	450
Goepel, Ruston E.T.	200
Goldenberg, Mr. Mark	500
Goldsmith, Mrs. June	100
Gooderham, Mrs. June	100
Goodison, Janice M.	100
Gordon, Ms. Dorothy	1,000
Gordon, Dr. Paula	5,000
Gosling, Mr. Gordon A.	100
Gourlay, Mrs. Nora D.	1,700
Gracia, Fernando J.	200
Graham, Mrs. Isabelle J.	300
Graham, Mr. P.L.	100
Graham, Mrs. Mary	100
Graham, Mrs. Tricia	100
Graham, Mrs. Elizabeth A.	500
Graham, Ms. Connie	200
Grauer, Miss Sherry	200
Gray, Ms. N. Victoria	100
Greenbank, Mr. David	100
Greenlaw, Ms. Barbara A.	1,000
Greenwell, Mr. Robert	100
Greer, Mary F.	100
Griffin, Mary-Louise	100
Griffith, Mrs. Lillian	100
Gropper, Mr. Mitchell	100
Groves, Ms. Myrtle M.	100
Gudewill, Miss Catherine	100
Gunder, Mrs. Laura	100
Gursky, Mr. David	150
Guthrie, Miss Margaret	100
Guyot, Mr. & Mrs. George	132
Habersack, Ms. Bernadette	100
Haddad, Bruce	100
Hadland, Mrs. Mabel	100
Hadley, Ms. Louise P.	100
Hadym, S.	100
Hagelund, Mr. Albert	100
Hager, Mrs. Judith F.	100
Hagnes, Mr. Edward	100
Hall, Ms. Joan	100
Hall, Mr. Edward	100
Hallett, Mr. W.B.	100
Hallett, Ms. Catharine	100
Halliday, Mrs. B.	100
Halliday, Mr. James	100
Hameer, Mr. Salim	100
Hampson, Mrs. Rosemary	212
Hanbury, Mrs. Norma	100
Hanson, Ms. Brenda A.	200
Hardman, Mr. Gerald	500
Harlos, Mr. & Mrs. J.	100
Harris, Miss Doris	100
Harris, Mr. Gene	100
Hart, Herbert	100
Hart, G. Arnold	100
Hart, Ms. Janet M.	100
Hawkesworth, R.J.	100
Hawley, Mrs. Marion	1,000
Haynes, Mr. William A.	1,000
Haynes, Miss Muriel	200
Haynes, Mr. Montague	150
Hayward, Marie	100
Heaney, James & Helen	100
Heaney, Mrs. James	100
Heaps, Ms. G. Audrey	150
Hebenton, Mr. Sholto	100
Helgason, Dr. Robert E.	100
Helgason, W.R.	100
Heller, Mrs. H.	100
Helmcken, Mrs. Elspeth G.	300
Hendel, Mr. Adam	100
Henderson, John D.	100
Henderson, Gordon & Freda	200
Henderson, Frank	100
Henderson, Mr. Walter	100
Henriquez, Mrs. Carol	100
Herchak, Roman	500
Hetherington, Mrs. Audrey	100
Hey, Mr. Donald	100
Hilderman, Mr. & Mrs. T.	500
Hillier, Mr. Richard	100
Hine, Mrs. Betty	100
Hinkson, Mr. Justice E.E.	100
Hobbis, Mrs. E. May	100
Hollenberg, Mr. Irvine F.	1,000
Holmes, Mrs. Susan	100
Holroyd, Edith	100
Home, Mr. George	250
Homer, Mrs. Mary I.	100
Hooper, Mrs. Joyce L.	150
Hooper, Mrs. Heather	100

Hope, William 100
Hornstein, Mr. Herbert 2,600
Horton, Mrs. Barbara 100
Horwood, Ms. P.M. 100
Hoskins, Mr. H.C. 300
Hoskins, Mr. M.D. 200
Houssian, Mrs. Joe S. 100
Howard, Lillian 100
Howard, Mrs. Patti 100
Howard, Mrs. Barbara 100
Howay, Mr. Robert 100
Hoyer, Ms. Ellen 550
Huckell, Mr. Ken 100
Huculak, Mr & Maureen 100
Hudson, Ingeburg 100
Hudson, Mrs. Patricia 100
Hudson, Mrs. Margaret O. 100
Hufsmith, Mr. R.L. 100
Huish, Mrs. Betty C. 100
Humphries, Mrs. Annie 100
Humphries, Ms. Bernice 100
Hunger, Mr. Herman 100
Hungerford, Mrs. F. Mary 500
Hungerford, Mr. R.M. 100
Hungerford, Mr. George 100
Hurl, Mrs. Donna B. 100
Hyatt, Mrs. Jean 100
Hyland,
Mr. & Mrs. J. Norman 200
Hyland, Ms. V. Zelma 100
Iallonardo, Ms Roberta 100
Ing, Mr. Albert 225
Ingledew, Mr. H.G. 100
Ireland, Mrs. Heather 100
Ireland, Mr. William E. 3,000
Israels, B.J. 100
Israels, Q.C., Mr. Richard 1,000
Ivey, Richard M. 100
Jack, Mr. William 100
Jacobs, Mr. Raymond A. 100
Jacobson, Mrs. Lawrence 100
Jambor, Mr. John L. 2,500
Jang, E. 100
Janzen, Ms. Cheryl 400
Jarvis, Mrs. Elizabeth 100
Jarvis, Mr. Raymond 100
Jarvis, Mrs. Wendy 100
Jeanes, Mrs. Viola 5,000
Jenkins, Mrs. Sylvia 100
Jenkins, Mrs. Marilyn 100
Jennings, Mr. David 100
Johnston, Mrs. Lois M. 100
Johnstone,
Mr. & Mrs. James Y. 100
Johnstone, Mrs. Victoria M. 100
Jolivet, Mrs. Patricia 100
Jones, Raymond 100
Jones, G. Gordon 100
Jones, Mr. & Mrs. D.E. 100
Jordan, Mr. Frederick 1,000
Jordan, Mr. R.A. 100
Jory, Mrs. Mary 100
Joy, Mrs. Annie H. 100
Joyce Mrs. Alice P. 100
Jukes, Mr. Andrew J. 200
Kacan, Mr. Sandy 500
Karran, Vivian 100
Keatinge, Mr. Gordon 2,000
Keevil, Mrs. Susan 100
Keevil, Mrs. Jane V. 100
Keill, Mr. R.T. 200
Kelch, Mr. Gerd 100
Kellett, Mr. Geo C.B. 150
Kellington,
Mrs. Sheelagh M. 200
Kennedy, Mrs. Margaret 100
Kennedy, Mr. C.D. 200
Kennedy, Ms. M. Lynne 100
Kennedy, Ms. Margaret C. 300
Kerssens, Mr. Nick 312
Killam, Ms. Kathryn H. 100
Killam, Ms. Judy 100
Killam, Mrs. F. William 100
King, Mr. Jack N. 100
King, Dr. Kenneth 100
Kingsmill, Mrs. H.A.G. 100
Kinloch, Mr. & Mrs. H. 500
Kinsella, Mrs. Brenda 200
Kipp, Ms. Evelyn E. 100
Kirkpatrick, Mr. P. 100
Kirwen, Mrs. Sheila 300
Kissel, Mrs. Mary 100
Klaassen, Mrs. Louise 100
Klaassen, Dr. David 1,500
Knott, Mrs. Jane M. 100
Koerner, Mrs. Eileen 1,000
Kohut, Julius & Ann 100
Krauchek, Mr. & Mrs. W.J. 100
Kudsus, Mrs. Dona J. 100
Kwok, Mr. Kwong Yong 1,000
Laing, Ruth A. 100
Laird, Mrs. Arleigh 500
Lake, Mrs. Phyllis 100
Lam, Mr. & Mrs. Paul 100
Lam, Mr. Y.M. 100
Lamb, Ms. Joyce R. 100
Lamb, Mrs. Shirley M. 100
Lambert, Ms. Beverly 100
Lancaster, Mr. David 100
Langergraber, Leo 200
Lawrie, Mr. James B. 100
Lazazzera, Mr. Walter 100
LeRose, Mrs. Velia 100
Learman, Ms. Emily M. 100
Lee, Jenny 200
Lee, Mrs. Mo Jing Ellen 100
Lee, Ms. Marguerite J. 100
Lee, Mr. Milton G.H. 100
Lee, Mr. James 545
Legeard, Mrs. Ellen 100
Legg, Mr. Hugh P. 200
Legg, Mr. Edward G. 100
Leith, Mr. Murray V. 200
Leith, Mrs. Susan 100
Lemer, Miss Helen 100
Lemieszewski, S. 1,000
Lemoine, Mrs. Marjorie 100
Lenehan, Mrs. Helmy 100
Leonidas, Mrs. M. 500
Letson, Mr. Gordon 100
Leung, Jimmy 100
Lewis, Mr. John 100
Lewis, Mrs. Cynthia 100
Lewis, Mrs. Janet 100
Lewis, Mrs. Susan E. 100
Li, Mr. Gilbert 200
Lindquist, Mr. Arthur 100
Linney, Gordon P. 100
Linsley, Mrs. Anna 100
Linwood, Ms. Gladys 100
Little, Mrs. E.J. 100
Littlejohns, Mrs. Pauline 1,000
Litwinow, Oleg 100
Liu, Mr. J. 500
Lockhart, Ms. Barbara K. 100
Logan, Jack 100
Long, Mr. A.M. 500
Lonnop, Mrs. V. 500
Lord, Elizabeth 100
Lougheed, Ms. Norma 40,000
Low-Beer, Frank H. 200
Ludbrook, Mr. Robert 100
Lum, Mr. Ken 100
Lundell, John O.E. 200
Lustig, Liliana 500
Lusztig, Peter & Penny 100
Lyall, Mrs. Marigold 100
Lycett, Ms. Doreen 150
MacAulay, Mrs. Alice M. 100
MacCrostie, Ms. Joyce 100
MacDonald, D.B. 100
MacDonald, W.J.D. 100
MacDonald, Ms. Violet 100
MacDonald, Mr. Angus 100
MacDougall, Mr. Stuart 100
MacDougall, Mrs. Angela 100
MacFarlane, Mrs. Shirley 100
MacFarlane,
Mr. & Mrs. Gordon B. 100
MacIntosh, Mr. Robert M. 100
MacKay, Colin B. 500
MacKay, Roderick 100
MacKay, Miss Lucille 100
MacKay, Mr. H.J. 1,000
MacKechnie, Dr. H.A. 200
MacKenzie, John W. 100
MacLean, Mr. Donald 100
MacLean, Mrs. Joan 100
MacLean, Mr. Victor 400
MacWilliam,
Mr. & Mrs. John M. 100
MacWilliam,
Mr. & Mrs. Donald 100
Macey, Mr. William J. 200
Machin, Mrs. Celia 200
Mackay, Dr. Colin B. 500
Mackay, Ms. Lucile 400
Mackay-Dunn,
Mrs. R. Hector 100
Mackenzie, Mr. James 100
Mackie, Mrs. Stephanie 100
Madden, Mrs. K.M. 200
Mah, Mrs. Bella 200
Mahabir, Mrs. Gilda 100
Mahony, Mrs. Carol 100
Maleszewski, Mr. & Mrs. S. 100
Malkin, Ms. M.L. 100
Malkin, Miss Ursula 100
Malkin, Ms. H. Louise 100
Malkin,
Mrs. H. Richardson 1,000
Mandziuk, Mr. George 100
Manning, Mrs. Doris 100
Manning, Mr. & Mrs. L.J. 100
Mansell, Mrs. Dean 100
Manson, Mr. James 100
Mapson,
Mr. & Mrs. Herbert 300
Marceau,
Mr. & Mrs. Maynard 100
Marceau, Ms. Barbara 200
Margetts, Mrs. Doreen M. 100
Margolis Nadel,
Mrs. Josephine 100
Markowsky, Mr. William 100
Marks, Mrs. Sumiko 250
Marks, Ms. J.L.N. 100
Marsh, Mrs. Kathleen A. 100
Marshall, Mr. John 150
Marsland, Mr. Gene E. 200
Marten, Miss Olive 100
Martens, Mr. Jacob E. 175
Martens, Mr. Bob 500
Martin, Miss Danae Maria 200
Martin, Mrs. Carolyn A. 100
Martin, Mr. Andrew 1,000
Martin, Mrs. M. Augusta 100
Mason, Mrs. Victoria E. 100
Massullo, Mrs. Florida 100
Massullo, Mr. & Mrs. Enrico 200
Masters, J.D. 100
Mathisen, Mrs. B. Margaret 100
Matson, Mr. William 100
Matthison, Mr. & Mrs. H. 100
Mavor, Mrs. Irene 100
Maxwell, Margaret 500

Mazzocato, Mr. Livio 1,000
McAlpine, Mr. John 100
McArthur, Mrs. Helen L. 100
McAvoy, Mr. J. 100
McBride, Mr. Stanley 250
McCarthy, Mr. William 1,250
McCarthy, Mrs. Dolores 1,250
McCarthy, Alice 2,500
McCarthy, Daniel 250
McCollin-Moore,
Rev. & Mrs. E. 550
McConnell, Mr. R. 100
McConville, Ms. Joan 100
McConville, Ms. Barbara 100
McCormack,
Mr. & Mrs. Robert 100
McCrirrick, Mr. Bryce 100
McCusker,
McDermid, Mrs. Mary 100
McDermid, Mr. John C. 100
McDermott, Mrs. Gisele 100
McDonald, Patricia 100
McDonald, Mrs. Mary 500
McDonald, Mr. Geo W. 100
McDonald, Ms. Joanne S. 200
McDonald, Mrs. Ann N. 200
McDonald, Mr. W. Kyle 200
McDonald, Mr. Jack 100
McDonald, Ms. Kim 120
McFarland, Ms. M. 100
McFaul, Mr. K. 100
McGavin, Mr. Brian N. 100
McGavin, Mrs. Sheahan G. 100
McGeer, Mrs. I. Patricia 100
McGillivray, Mr. James F. 100
McIlwain, Mrs. Phyllis 100
McIntosh, Mrs. Nicolette 100
McIntosh, Mrs. Ethel T. 100
McIntosh, Mrs. Lorna 100
McIntyre, Mrs. L.H. 100
McKeen, Mr. George B. 100
McKeen, Mrs. Joan L. 500
McKeen, Mrs. Deborah 100
McKellar, Mrs. June 100
McKendy, Mrs. Eilish 100
McKenzie, Susan 550
McKercher,
Mrs. Elizabeth D. 100
McKoryk, Peter 100
McLauchlan, Mr. James 100
McLean, Ms. Linda 100
McLean,
Mr. & Mrs. Harold G. 100
McLeod, Edith 100
McLeod, Ms. Judy M. 500
McLernon, Mrs. Peggy 100
McLoughlin, Mrs. Lynn 100
McMahon, Mr. E. Michael 250
McMartin, Mr. Richard 100
McNeill, Mrs. Mary A. 100
McRobb,
Mr. & Mrs. Gordon 200
McWilliams, Stewart 200
Mearns, Ms. Lindsay 100
Mearns, Mr. Alan N. 500
Mearns-Brown,
Miss Marilyn 100
Medeiros, Alfredo & Agnes 300
Mehr, Ms. Judith A. 200
Melnyk, Mr. Alexander 100
Melnyk, Mrs. Jennie 200
Melvin, Mrs. Patricia 100
Mercer, Walter & Bev 130
Milacek, Mr. Stan 1,000
Miller, H. 100
Miller, Mrs. Violet 1,000
Miller, George M. 300
Milner, Mr. John 100
Milner, Mrs. Friederike 100
Milsom, Mrs. M. Lois 100
Mindell, Mrs. Darrell 100
Mitchell, Mrs. Jane 100
Mitchell, Ms. Doreen 100
Miyoshi, Mrs. Arlene 100
Moffat, M.D. 100
Molcak, Mrs. Ruth 100
Molnar, Mrs. Hanna 100
Molson, Mrs. Marni 100
Molson, Ms. A. 200
Monteith, Mrs. Carol 250
Montgomery, Mr. J.D. 100
Moon, Mrs. Sheila 100
Moore, Mrs. Margaret L. 800
Moore, Mr. Fred B. 250
Moore, Mrs. W.F. 250
Moore, Ms. Evelyn 100
Morrell, Mrs. Esther 100
Morris, Colin G. 100
Morris, Mrs. Joanne 100
Morris, Mrs. Shelley 100
Morrison, Mrs. Violet 100
Morrison, Mrs. Olive 100
Mortifee, Mr. A.W.S. 100
Mortimer, Mr. & Mrs. H.E. 100
Mosher, Evelyn 100
Mott, Lawson 500
Mouat, Isabella 200
Moul, G. Edward 100
Moul, Mrs. Penny 100
Muir, Mr. W. Keith 100
Mullinger Bogoch,
Dr. Margaret 100
Munro, Ms. Jennifer 500
Murphy, Kathleen 100
Murphy, Karen 115
Murphy, Mrs. D.G. 100
Murphy, Mrs. Muriel J. 250
Myer, Mrs. Ethel 200
Myles, Mr. & Mrs. R.A. 200
Nagy, Mrs. Irene 100
Nagy, Mrs. Jennie 500
Nakamura, Mr. Edward T. 100
Nakatsuka, Mr. Gerald E. 100
Natsuhara, Miss Lucy 100
Negraiff, Mrs. Annie 100
Neilson, Mrs. Vera 100
Nelson, Miss Shirley A. 100
Nelson, Mrs. Jacquie H. 100
Neufeld, Mr. & Mrs. George 100
Neville, Mrs. Alice 100
Newman, Graham & Joy 100
Ng, John Ka Chow 100
Nherlan, Ms. Ingelise 1,605
Nichol, Mrs. Elizabeth 1,000
Nip, Mr. & Mrs. Donald 100
Nisbet, Mr. C. 150
Noble, Dr. & Mrs. J.R. 15,000
Nolt, Mrs. G. 500
North, Mrs. Patricia 100
Notman, Ms. Heather 200
Nyarady, Ms. Anna 100
Nyden, R. 100
O'Brien, Miss Anne 100
O'Brien, Mr. Peter J. 100
O'Callaghan, Miss Shelley 100
O'Callaghan, Miss Diana 100
O'Callaghan, Ms. Jane 100
O'Keefe, Mrs. Brenda 100
O'Kiely, Mrs. Elizabeth 100
O'Neill, John J. 500
Oddy, M. Judith 100
Olive, Mrs. Avro C. 500
Oliver, Mr. H.C. Hank 100
Olivotto, Mr. Mrs. I.S. 100
Oswald, Mrs. Hilary M. 100
Oughtred, Ms. Runa 100
Oughtred, Mr. W.T. 500
Owen, Mrs. Helen S. 100
Owen, Mrs. Brita J. 100
Owens, Mr. O.E. 100
Palcic, Dr. Branko 200
Paliotti, Ms. Monique 100
Paliotti, Ms. Gina 100
Palmer, Mr. John 100
Pardee, Charles H. 100
Parker,
Miss Dewey Patricia 100
Parslow, Mr. Ralph 500
Patterson, Mr. Alan N. 100
Pattillo, Mrs. Susan 100
Pawlitza, Vera R. 600
Payne, Mr. Robert 1,000
Peacock, Kathleen L. 100
Pearkes, Mrs. Joyce M. 100
Peebles, W. Nelson 100
Peets, Mr. Terry 100
Pegg, Ms. Judith E. 500
Pekarsky, Ms. Trudy 100
Pekrul, Mrs. Margaret 100
Peretz, Ms. Susan 100
Peters, Mr. & Mrs. Ronald 100
Peters, Ms. Heidi Freya 200
Phillips, Mr. E.C. 200
Phillips, Mrs. Patricia R. 500
Pike, J.A. & I.G.A. 100
Pike, Mr. & Mrs. James A. 100
Piller, Janet 100
Pinnell, Ms. E. Patricia 100
Pitblado, Mr. James B. 1,000
Pither, Mr. W. Garth 25,000
Pittalwala, Anoop 400
Pitts, Mrs. Margaret B. 1,000
Pitts, Mr. John W. 1,000
Plaxton, Mr. Gordon 100
Plumridge,
Mrs. Ethel & Arnold 100
Pollard, Mrs. Norah 100
Poole, Mr. John 100
Popoff, Ms. Anne 100
Potter, Ms. Monica 100
Pottinger, Miss Beatrice 100
Pringle, Jr., Mr. Ed 100
Prinster, Monica 100
Purdie,
Mr. & Mrs. John & Donna 100
Purdy, Miss Jill 100
Pye, Mr. Percy B. 100
Radcliffe, Mrs. Agi 100
Rae, Elma 100
Rae, Mrs. Kelly Jane 100
Ragona, Ms. Susan 100
Ramsey, E. 200
Rapin, Mary 100
Read, Ms. Christina M. 100
Reddy, Dr. Suseela 100
Redmond, Mrs. Sandra 100
Reesor, Miss Diane 1,000
Reid, Mrs. Doreen 100
Reid, Ms. Janet W. 250
Reid, Mr. & Mrs. Neil B. 100
Reiners, Mrs. Edith 100
Revelant,
Mr. & Mrs. Leonardo 100
Reynolds, Mr. Harry 100
Reynolds, Mrs. Georgina 100
Richards, Miss Virginia 100
Richardson, Ms. Marian 100
Richler, Miss Nancy 100
Ridley, Mrs. Cara Lee 100
Riley, Ida 125
Ringrose, Mrs. Ethel 100
Riske, Mr. & Mrs. J. 200
Ritchie, Mrs. Erica 200
Robbins, Ms. E. Madge 100
Roberge, Mr. & Mrs. Eddie 100
Roberge, Mr. Hector 100

Robertson, Ms. Carol 100
Robinson, Mrs. Barbara J. 100
Roddick, Mrs. Valerie 100
Rogers, Mrs. Gwynneth 1,000
Rogers, Mrs. Gail 100
Rogers, Miss Betty 200
Rogers, Ms. Elsbeth 100
Rootman, Dr. Jack & Jenny 100
Rose, Mr. Ernest G. 2,000
Rose, Mrs. Patricia 200
Rose, Mr. John M. 100
Rothstein, Etho 1,000
Rowe, Robert S. 200
Rufino, Archide 200
Ruscheinsky, Mr. Theodore 100
Russell, Mrs. Daisy 100
Russell, Mr. Alfred 100
Rust, Miss Hope 100
Saba, Mrs. Eileen 100
Salomon, Mr. Albert 100
Sam, Mr. Tom 100
Sandwell, Mrs. I. Agnete 500
Sankey, J.H. 100
Sankey, Mrs. Jean 100
Sargent, Brig D.R. 100
Sargent, Mr. Les 150
Sarkari, Mr. Noshir 250
Sarkari, Mr. & Mrs. N.P.D. 100
Sauder, Mr. W.L. 100
Saunders, Mrs. Nancy 1,000
Savard, Mrs. Diana 100
Savenye, Mr. Fred 200
Sawers, Mrs. E. Joan 100
Sawula, Mr. Stanley 1,000
Sawyer, Mr. & Mrs. Ronald 200
Sawyer, Mr. Lloyd 200
Scarr, Mrs. Janette 100
Schack, Lois E. 200
Schermerhorn, Mrs. Margaret 100
Schimmelfennig, Ms. Lorraine A. 100
Schlieper, Mr. Erich 100
Schmidt, Mrs. Lauren 100
Schofield, John & Evelyn 100
Scholefield, Ms. Marguerite 100
Schonfeld, Mrs. Tracey 100
Schramm, Mr. Richard G. 500
Schug, Ms. Lorna M. 2,000
Sciotti, Mrs. Mary 100
Scott, Mr. Adam 100
Scott, Mr. Bill 300
Segodnia, G.T. & Lydia 100
Serediuk, Mr. George N. 100
Sexsmith, Mr. William 1,000
Shannon, Mrs. V.O. 200
Sharp, Mrs. Diana 100
Sharp, Mr. R.W. 100
Shaw, Joel & Ginette 100
Shaw, Mr. Irving 100
Shaw, Mrs. Yvonne 200
Shaw, Ms. Patricia N. 100
Shepherd, Mrs. L. 300
Sherlock, Mr. John 100
Shindler, Ms. Sharon 100
Shon, Mrs. Sharon 100
Shortreed, Mr. William 100
Siermy, Joe & Annie 1,000
Sim, Ms. Colleen 100
Simpson, Mr. Ronald 100
Sinkovics, Andy 150
Skelping, Mrs. E.C. 100
Skelton, Mrs. Doris K. 3,100
Skov, Mrs. Esther 1,000
Sloan, Mrs. Marga 100
Small, Alfred 100
Smart, Mr. Kenneth M. 100
Smidt, Mr. John 100
Smith, Ms. Janet 500
Smith, Mr. John 250
Smith, T.C. 100
Snape, Mrs. Margaret 100
Snelgrove, Beatrice 100
Sonntag, H. Paul 100
Sood, Mrs. Lata 100
Soong, Raymond 100
Southam, Ms. Susan 100
Southam, Mrs. Gordon T. 1,000
Spence, Mr. Lindsay 100
Sproul, Doug & Eleanor 100
St. Germain, Ms. Shirley H. 3,000
Staniszkis, Ms. Joanna K. 100
Stark, Mrs. Virginia 100
Stashuk, John 250
Steele, Mr. Ewen 100
Steele, Mr. Donald R. 100
Steer, Mr. William B. 150
Stenstrom, Ms. Mary L. 160
Stevens, Mrs. Barbara 200
Stevens, Mr. Leslie 100
Stevenson, Ian 100
Stewart, W.R. 100
Stewart, Mr. Oswald J. 500
Stewart, Ms. Della J. 500
Stewart, Mrs. Myrtle 100
Stockmayer, Mr. Otto 100
Stoneman, Mr. Wade 100
Stowe, Mr. David H.R. 200
Strathdee, Miss Ada 100
Stratton, Mrs. Vivian 100
Stringer, Mr. G.V. 100
Sturgeon, Mr. J.A. 1,200
Sturgess, Mr. Roy 200
Such, Lionel S. 500
Sung, Lily K.S. 1,000
Surine, F.H. 125
Sutherland, Ms. M. 100
Swallow, Mr. Lewis 100
Taggart, Judge Valerie 350
Tateyama, Ms. Julie 100
Tautorus, Mr. Emil 100
Taylor, Mr. George 100
Taylor, Mr. H. 100
Taylor, Ms. Daphne 100
Taylor, Ms. E. 100
Taylor, Mrs. Lillian 100
Taylor Phillips, Mrs. Carol 100
Tennant, Mrs. Joan V. 100
Tepoorten, Mrs. Marion E. 100
Thompson, Susan 500
Thompson, Charles A. 500
Thompson, Mrs. H.A. 100
Thompson, Mr. J. Harold 1,000
Thompson, Mrs. Salley 100
Thorne, Mr. Walter 200
Thornton, Leith & Joan 100
Thornton, Mrs. Joan 300
Timbers, Mr. L.E. 500
Tipple, Mrs. Judy 100
Tollardo, Mrs. Emilie 200
Tolmie, Mrs. Patricia 100
Townsend, Mr. Robert 100
Trapp, Mr. Robert 100
Travis, Ms. Louise M. 1,000
Tuck, Ms. Mary 100
Tucker, Mrs. Myrtle 350
Turnbull, Mrs. Janis F. 100
Turnbull, Ms. Mona R. 100
Turner, Mr. Leslie A. 100
Turner, Mr. James 100
Turner, Mr. Emil G. 150
Turner, Mr. John 100
Turpin, Mr. J.F. 100
Twiddy, Mrs. H.G. 750
Twiss, Mr. William 200
Twite, Dr. Anthony 100
Tymchuk, John H. 200
Tysoe, Ms. Dora 100
Underhill, Mr. Richard 200
Valgardson, Christina 100
Vallance, Mr. Garry 100
Van Roggen, Mrs. Jane E. 1,250
Van Santen, Mrs. Mieke 100
Van Slatte, Mr. P.H. 500
Van Vugt, Mr. Joseph 100
Van der Vliet, Mrs. Helen 1,000
Vandekerkhove, Karen 150
Vander Ploeg, Mr. Sander 500
Vanderzwan, Mr. Gysbertus 100
Vatcher, Mr. M.J.R. 100
Vaughan, Mrs. J.A. 100
Venables, Mr. Frederick 100
Waddell, Mrs. Sally E. 100
Waldman, Ms. Shirley 5,000
Waldock, Mr. & Mrs. G. 100
Walker, Mrs. Doreen E. 100
Wallace, Ms. Rosalind 100
Wallace, Mr. & Mrs. R. 100
Wallace, Mr. & Mrs. W.M. 100
Wallace, Mr. John A. 100
Ward, Mrs. K.E.S. 300
Warren, Mrs. Sally R. 300
Warren, Mrs. A.J. 300
Waters, Mr. & Mrs. P.D. 500
Watson, Mr. James 100
Watson, Mr. Don N. 200
Waygood, Mr. E.R. 100
Weaver, Mr. Kenneth R. 200
Webb, Mrs. Janet 100
Wedge, Ms. Wendy 250
Weedon, Mrs. Eileen 100
Wegwitz, Mr. E. 100
Weir-Jones, Mrs. Elizabeth 100
Welsh, Sydney 200
West, Mrs. June 100
West, Mr. Emile 200
West, Ms. Edith H. 2,000
West, Mr. John 100
West, Ms. June C. 100
Whiles, Ms. E. Luanne 100
White, Dale & Pat 200
White, Mrs. Mary I. 100
White, Ms. M.J. 100
White, Mr. Albert 100
Whittall, Mr. H. Richard 100
Whittall, Mrs. Jocelyn O.C. 1,000
Wiasuk, Mr. Alexander 200
Widdowson, Mr. & Mrs. Norman 1,000
Widdowson, Mr. N. 1,000
Wignes, Mrs. Kathleen 100
Wiig, Mrs. Kari 100
Wilhelm, Ron & Darla 550
Wilkinson, Mr. Terry 500
Wilkinson, Mrs. Anne 100
Wilkinson, Ms. Joan B. 100
Williams, Miss Maureen 200
Williamson, Mrs. Violet J. 200
Willis, C.N. 100
Willis, Mrs. Louise 500
Wills, Mrs. Cora 100
Wilson, Eleanor 100
Winskill, Ms. Aileen 1,000
Wolfe, Dr. J. Blair 350
Wolfe, Mr. Stuart E. 100
Wolff, Stanley D. 200
Wong, Philip 100
Wong, Mrs. Rita 100
Wong, Ms. Stella T. 100
Wong, Mr. Yee 100
Wong, Mr. Tommy C. 100
Woodcock, Mrs. Dixie 100
Woodward, R. 150
Woodward, Ms. Elizabeth 100

Woodward, Mrs. Carol	1,000
Woodward, Mrs. Cynthia	100
Woodward, Ms. E. Wynn	100
Woolley, Mr. Charles E.	200
Wooster, Frances A.	200
Worster, Margaret	100
Wosk, Mr. Sonny	500
Wotherspoon, R.B.	400
Wotherspoon, Mr. Wm.	100
Wratislaw, Mr. Henry	100
Wright, Mr. A.B.	100
Wu, Mr. Hing	100
Yamamoto, Mrs. Takiko	100
Yeomans, Mr. Frederick	100
Yorke, Mrs. Margaret	100
Young, Mr. Ira	100
Yu, Mr. & Mrs. N.	300
Yung, Mrs. Elizabeth	100
Zabel, Mr. J.A.	100
Zacharuk, Michael	100
Zajac, Mr. Melvin	100
Zorn, Mr. Joseph	100

5000 Kingsway Ltd.	5,000
A.M. Stevens Contract & Woodwork Ltd.	100
AGT - Staff	120
Air B.C.	100
Allright Ladder Co. of Canada Ltd.	100
Alpha Pharmaceutical Supplies	100
Anglo Canadian Shipping Company	100
Assoc. Cdn. Travellers-Kamloops Ch.	100
Atlas Iron & Metals Ltd.	300
Atmospheric Environment Service	221
B.C. Gas Inc.	12,500
B.C. Hydro & Power	35,000
BCE Development Corporation	500
Bacci's Design Ltd.	100
Baldwin Wah Enterprises Ltd.	200
Bank of B.C. - Staff	185
Bella Coola Fisheries Ltd.	200
Beta Sigma Phi Chapter	700
Bosa Bros. Construction Ltd.	100
Bosa Construction Inc.	100
Bosa Development Corporation	100
Broadway Properties Ltd.	10,000
Bruneau & Associates Realty Ltd.	100
Buckler, Ashurst, McMartin, Main	100
Canadian Airlines International Employee Charitable Donation	23,402
CIBC - Staff & Management	150
Canadian Imperial Bank of Commerce	1,000
Canadian Union of Public Employees	200
Cdn. Hydrographers Association	100
Central Okanagan Foundation	300
Century Plaza Hotel	100
Chancery Software Ltd.	1,000
Cloverdale Paint	500
Collingwood Centre For Seniors	200
David's Painting & Decorating	100
Davis & Company	3,000
Demidoff Construction Ltd.	100

Diamond Foundation	42,350
Diversicare	100
Dogwood Credit Union	100
Dr. H. Chaun Inc.	100
Empress Foods	123
Evabelle Inc.	100
Evergreen Kennel Club	100
F.O.E. - Northwest #2638	2,000
F.O.E. - B.C. Provincial Auxiliary	40,146
F.O.E. - Van. Aerie 2075	500
Fairway Holdings Ltd.	100
Far West Air Conditioning Ltd.	500
Fibron Machine Corp.	300
Findlater Lumber Ltd.	100
Fleck Bros.	100
Fook Wah Enterprises Ltd.	100
Fraser River Pile & Dredge Ltd.	100
Glenayre Electronics Ltd.	250
Good Companions Club of S. Burnaby	200
Gorge Road Hosp. Employee Fund	616
Grace Hospital	100
Greater Victoria Hospital Society	1,653
H.R. May & Sons	100
Harrison Hot Springs Sand Sculpture	145
Hazel & Co.	100
Helix Biotech Corporation	2,514
Hellenic Women's Auxiliary	300
Highland Valley Copper	250
Hongkong Bank of Canada	1,200
Hospital Employees Union	100
IBM Canada Ltd.	250
Insurance Corporation of B.C.	100
Int. Brotherhood of Boilermakers	100
Int. Order of Job's Daughters	100
Jack Cewe Ltd.	250
Jantzen	645
Jessie R. Burke Memorial Fund	440
Josco Holdings Ltd.	20,000
K.C. Foster & Associates Ltd.	100
Kamloops Jaycettes	122
Kernaghan Adjusters Ltd.	100
Kim Sue Enterprises Ltd.	3,000
Kingsway Holdings Ltd.	650
L. Denning Arbitrators Ltd.	300
L.G.H. Employee Charity Fund	100

Le Kindli-Restaurant Suisse	100
Les Hall Filter Service Ltd.	200
Leslie Investments Ltd.	650
Lucerne Investments Limited	1,000
M.L. Henley CHTBL FDN	1,000
Macdonald Dettwiler and Associates	2,000
Marina Garden Estates Ltd.	250
Marsh & McLennan Limited	100
Marshall, Goldsworthy & Associates	100
Mast Cameron Hall	100
May & Sons Limited	100
McLean, Budden Limited	500
McNap Management Ltd.	100
Mitch Duncan & Dave's Friends	100
Molson Brewery B.C. Ltd.	710
Montrose Developments Ltd.	500
Morden & Helwig Limited	300
N.C.W. Engineering Inc.	100
National General Expediters Ltd.	100
Nedco	
A Westburne Division	100
Needs of Victorians	500
Norbill Investments Limited	125,000
Norco Products Ltd.	2,000
Nordic Wrecks Ski Club	100
O.E.S. - Adah Chapter No. 16	4,500
O.E.S. Grand Chapter - B.C. & Yukon	500
Oppenheimer Bros. & Company Ltd.	100
Order of the Royal Purple #277	400
Pacific Northwest Removal Service	200
Parkwood Manor - Residents	130
Peak Photo	100
Petley-Jones Gallery	100
Placer Dome Inc. - Exploration	30,000
Pleasant Valley Cleaners	145
Preceptor Beta Theta	1,000
Prospero International Realty Inc.	100
R.C. Purdy Chocolates Ltd.	100
Reed Stenhouse Limited	200
Richmond Inn – Staff	470
Ritchie Bros. Auctioneers	500
Rose & Crown	

Neighborhood Pub	107
Royal Canadian Legion	600
Royal Cdn. Legion - W.A. Branch 118	150
Royal Cdn. Legion - W.A. Branch 270	100
Royal Cdn. Legion - W.A. Van. East	100
Royal Jubilee Hospital	4,712
Russell & DuMoulin	250
Sauder Industries Ltd.	1,000
Shaughnessy Hospital - Employees	110
Shirley's Holdings Ltd.	5,000
Sight & Sound	100
Solifidian Construction	130
Soroptimist International	4,000
Spencer Aviation Services Ltd.	100
Strs. of Chrty. of Immaculate Cncptn	550
St. Edmund's School	1,000
St. George Transportation Ltd.	270
St. Mary's Ukrainian Catholic Church	1,000
Star Lake Womens Institute	200
Surrey Parks & Recreation Comm.	100
Teck Corporation	7,000
Telephone Employees' Comm. Fund	2,189
Telephone Pioneers of America	9,000
The 1945 Foundation	150,000
The Andrew Mahon Foundation	180
The Avery Clinic	250
The Fraser-Burrard Hospital Society	302
The Hulbert Group B.C. Ltd.	100
The Manufacturers	314
The Royal Bank of Canada	7,500
The Sisters of St. Ann	550
The Victoria Foundation	247
Thorne, Ernst & Whinney	100
Tillicum Holdings Ltd.	90,000
Top Valu Food Products Ltd.	100
Town Centre Leasing Ltd.	150
Ukr. Cdn. Prof. & Bus. Assoc. of Van.	1,000
Ukrainian Self Reliance Association	1,000
Ukrainian Women's Association	1,100
United Way of The Fraser Valley	3,830
United Way of the Lower Mainland	86,054
VU13	200
Vancouver City Savings Credit Union	164
Vancouver Foundation	39,608
Vancouver General Hospital Foundation	10,048
Vancouver School of Theology	550
Vanlin Holdings	2,000
Vict. Gen. Hosp. Employee Fund	1,215
Vonna Neal Emergency Fund	1,600
W.P.J. McCarthy and Company Ltd.	650
W.P.J. McCarthy and Company Ltd.	650
Waldie & Murray Insurance Services	100
Westcoast Energy Inc.	15,000
Western Forest Products Limited	5,000
Whistler Hockey Association	100
Whyt Bros. Painting	380
Weiser Inc.	200
Wolfe Chev Olds	100
Total Donations under $100	161,685
Total Donations, including fund-raising projects	$1,414,795

Included in the above figure are donations totalling $501,248. These gifts were made to the Capital Fund Campaign which the Foundation is conducting on behalf of the B.C. Cancer Agency. The balance of the above donations and bequests are used in the operations and maintenance of the B.C. Cancer Research Centre.

Bequests from the Estate of the Late:

Andrew, Mary Ellen	$ 1,000
Bartlett, Katherine	834
Bidder, Rubeena Jean	34,593
Boucher, Lily Beatrice	3,335
Brugger, Martha	18,777
Burtch, Doris	850
Crawford, Marion	39,746
Cullen, Elizabeth A.	2,000
Davidson, John Gibb	500
Dobson, Agnes Anne	25,000
Fielders, Phyllis Hambling	500
Fletcher, Evelyn Margaret	1,000
Glasson, Jean Pierre	7,500
Gray, Stanley Lewis	80,928
Irving, Mary Jeanette	5,000
Johnston, Dorothy E.	27,000
Jones, Maggie Rose	500
Lindberg, Mary Ina	5,000
Little, Eleanor G.	781
McCarthy, Clara	832
Mainwaring, Lenora E.	2,224
Niessen, Jacob	13,615
Norton, Gladys	1,081
Otley, Florence	1,000
Paradis, Antoinette E.B.	88
Parker, Janet Gray	1,300
Paynter, Alfretta	18,500
Rochester, Marguerite H.	1,000
Roy, Henrietta	35,500
Saimoto, Nobuko	2,000
Sanderson, Irene	145,000
Somolenko, Trephon (Thomas)	9,905
Stewart, Irene	156
Tweedie, Edith	2,334
Ward, Robert Almond	832
Wilkes, Robert W. S.	43,000
TOTAL	$533,211

Bequests designated for specific purposes:

From the estate of the late:	
Atkinson, Raymond George	$104,502
Brown, E. M. (Dr.)	180,000
Osler, William Ramsay	10,000
Royal Trust (for the Lavender Memorial Fund)	26,000
TOTAL Bequests to Designated Funds	$320,502